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ORIGINAL ARTICLES

THE RESULTS OBSERVED IN A FURTHER STUDY OF PRENATAL CAUSES OF DENTOFACIAL DEFORMITIES*

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"Scientific thought is not an accompaniment or condition of human progress, but human progress itself."—Clifford.

KARL PEARSON[1] in his conclusion respecting the claims of science says: "For the present, then, it is better to be content with the fraction of a right solution than to beguile ourselves with the whole of a wrong solution. The former is at least a step toward the truth, and shows us the direction in which other steps may be taken. The latter can not be in entire accordance with our past or future experience and will therefore ultimately fail to satisfy the esthetic judgment. Step by step that judgment, restless under the growth of positive knowledge, has discarded creed after creed, and philosophic system after philosophic system. Surely we might now be content to learn from the pages of history that only little by little, slowly line upon line, man, by the aid of organized observation and careful reasoning, can hope to reach knowledge of the truth that science, in the broadest sense of the word, is the sole gateway to a knowledge which can harmonize with our past as well as with our possible future experience."

It is then only through scientific investigation that the traditions regarding the relative relation of the dental arches, occlusion and their perversions can give way of tested truths. In orthodontia some real progress has been revealed to obscure questions during the past few years, it matters little if some of the determinants have not yet been discovered, nor if from the limited experience of our observations we failed to cover all the problems.

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 5, 1917.

Last year in Pittsburgh I had the pleasure of presenting before this society the results observed in my examination of embryos and fetuses,[2] and at that time showed there were definite malformations, as well as malrelation of the dental arches, prior to and at birth, and a few of the probable factors that were influencing the development of the facial area.

Unfortunately this paper was read just prior to the close of the meeting, preventing a full discussion. For that reason I earnestly hope that this subject will be thoroughly discussed at this meeting, as I consider the question of sufficient importance to again bring it before this society. In case there is no discussion, it will at least place before you some facts that might cause you to hesitate and ponder over before beginning the treatment of orthodontic cases.

At this time I will present further evidence to prove we have conditions that are of prenatal origin, irrespective of what a few of you might care to accept, and that we have merely scratched the surface of the etiology of malrelation of the dental arches and malocclusion. While mechanics in orthodontia has its place, if we are scientific orthodontists we should and *must* give more attention to the etiologic conditions we are handling.

That this problem is a serious one has been fully proved this past winter by men engaged in sister professions, especially those in pediatrics and infant feeding.

As I endeavored to explain last year, most of the material published so far in both the dental and medical textbooks concerning the "normal" skull at birth is inconsistent and contrary to careful observations, consequently misleading students and causing false conclusions. We have accepted these statements as true, neglecting to observe these things for ourselves, and thus we find we have been working from the wrong hypothesis and accomplishing little so far as etiology is concerned.

As the paper read last year was published in the November issue of the *Dental Items of Interest* you are undoubtedly familiar with it; nevertheless, I shall take the liberty of reviewing part of it.

The etiology of malformations depends either on internal causes or upon the action of external influences; thus etiologic conditions consequently depend upon one of the following three causes.

1. Direct family heredity, not only of the parents, but from the ancestors as well.

2. Pathologic. Not only disease, but all that pertains to it. Results are marked by irregularities.

3. Mechanical. Neither healthy nor pathologic.

"A malformation is generally defined as an alteration occurring during fetal development; i. e., a congenital alteration of one or more organs or systems of organs, or of the whole body, which does not come within the range of variation of the species."[3]

Nearly all malformations (embryonic and fetal) originate in the first six weeks of intrauterine life, or the embryonic period, and *"when the malformed embryo becomes a fetus, it carries whatever malformations it has into the*

fetal period, and is born with same."[4] Congenital malformation, therefore, is not always the product of late, but of early, uterine pathology.

Variations in the bones of the adult human skeleton are due to the chance persistence of transitory condition normally present in the embryonic or fetal skeleton and supposedly of phylogenetic importance. Studies show that the skeleton of the embryo is subject to fluctuating variations similar to those of the adult.

However, certain factors must be borne in mind as influencing the further growth and development of the individual. The form of the skeleton as a whole and of the individual bones which compose it may depend partly upon heredity, partly upon pathologic, and partly upon the mechanical or chemical influence to which it is subject during growth.

Mendel,[5] in speaking of the factors which determine the possibility of growth, says: "The factors which determine the possibility of growth, and upon which, therefore, any broad generalizations, regarding the abnormalities of growth, must be based, may be classed, with respect to the organism involved, as internal or external in character. The internal factors include the real impulse to grow, of whatever nature it may be; in part they are inherited, they belong to the permanent biological characteristics of the individual. Heredity, with all that it involves, determines the most potent of these internal, constitutional incentives and conditions of growth. These are the determinants which are largely beyond our immediate control, yet must be reckoned with when defects of growth appear. The external factors that modify growth, on the other hand, are more amenable to directive regulation. The environment of the individual can be modified more or less at will.

"In order to have a common basis for the discussion of the abnormalities of growth, some definition is essential, difficult though it may be to formulate one in entirely satisfactory terms. Even when the body as a whole no longer gains in size, individual parts like the hair and nails may continue to grow. It will be preferable to speak of such phenomena of localized growth as a renewal of tissues, and, likewise, to exclude from the category of real growth the deposition of fat and other reserve materials that often produce a gain in weight. 'Increment in size' or 'gain in weight' or 'enlargement of mass' are inadequate descriptions of the more specific characteristics of the growth of the higher forms. I have found no more helpful concise definition than that by Schloss[6] who characterizes growth as 'the correlated increase in the mass of the body, in definite intervals of time, and in a way characteristic of the species.'

"Perfect growth and development implies a far-reaching correlation of the various parts of the body. An upset in this nicely balanced relationship is speedily recognized as an anomaly. Energy and matter are sufficient to explain the comsummation and maintenance of a normal as contrasted with an abnormal composition of the cells. The specificity of growth is something marked, particularly when normal is contrasted with perverted growth. The definition referred to above has a particular value in the analysis of abnormalities of growth, because it immediately suggests some of the anomalies of irregularities. Abnormal growth may involve (1) the correlation feature, or (2) a time factor whereby the characteristic rate of the increase in mass is not maintained. The

correlation refers, for example, to the arrangement of matter in respect to composition and likewise to form. When there is overgrowth of one part or under development of another, the correlation is upset. This is abnormality. Likewise when the change in size is well proportioned or correlated, but unduly delayed or prolonged, growth becomes abnormal in its rate for the individual under consideration."

Fig. 1 shows a series of human embryonic skulls from the second month to the ninth month, front and side views, and illustrates the gradual growth of the skull. The relatively small size of the maxilla is a cause of the small dimensions of the fetal face, but at birth the maxillary sinus, which is only a slight depression on the medial surface, extends laterally into the maxilla and gradually enlarges until dentition is complete. As this maxillary sinus increases in size, the alveolar process develops and with the development of the teeth, brings about the growth of the maxilla mandible, and the corresponding parts of the face.

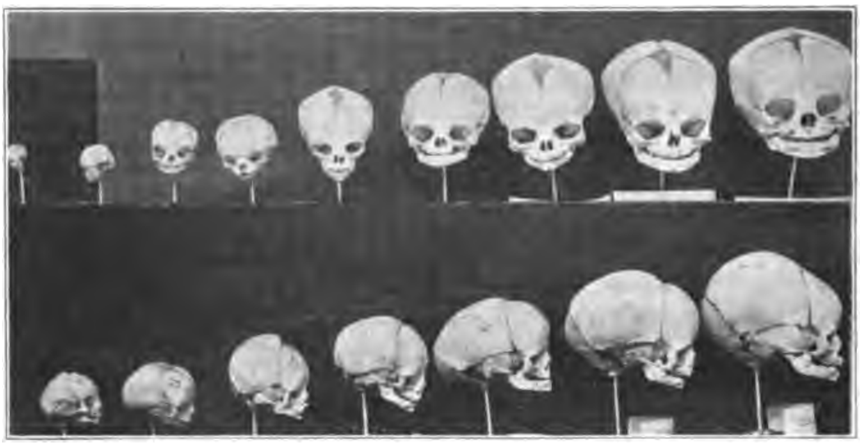

Fig. 1.—Series of embryonic skulls the end of the second month to the ninth month. Front and side views, illustrating the gradual growth of the skulls.

Fig. 2 shows the extensive coiling toward the ventral surface with the gradual uncoiling. First the trunk straightens out and the nape bend slowly becomes obliterated. This is accomplished by a rapid growth of the ventrally situated organs, especially the heart. With the straightening out of the nape bend, opportunity is offered for the formation of the neck.

The evolution of the face must depend upon the enlargement and fusions of the oral and nasal cavities, upon the partial separation of those cavities; leaving the posterior nares open, and upon the growth and specialization of the facial region of which the development and elongation of the maxilla and mandible is the most conspicuous indication. While this is occurring, there is a modification of the position of the face in relation to the brain, cranium, and heart. As the oral region develops, the extensive coiling of the embryo begins to straighten out and the heart descends.

Here I desire to bring to your attention a skull Cryer showed last year,

Fig. 2-*A*.

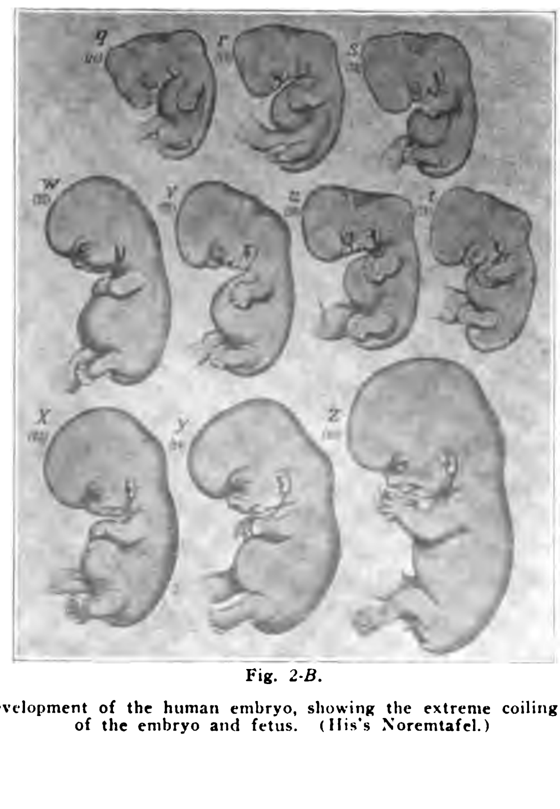

Fig. 2-*B*.

Fig. 2, *A* and *B*.—Development of the human embryo, showing the extreme coiling and gradual uncoiling of the embryo and fetus. (His's Noremtafel.)

an illustration of which is to be found in his second edition of the "Internal Anatomy of the Face," which I believe to be an abnormality, and not a "normal transverse section of a child's head at birth."

Fig. 3 is the skull of a fully developed embryo cut vertically through the first deciduous molars. Cryer, in describing this skull, says "the lower jaw is developed slightly in advance of the upper, * * * if a vertical line is drawn through the center of the tooth germs and the alveolar process of each jaw, it will be found that the lines of the upper jaw are on the inner side of those of the upper, the difference being one-half the thickness of the lower jaw, * * * as the teeth erupt, the lower acts as a matrix upon which the upper

Fig. 3.—Skull of a fully developed embryo cut vertically through the first deciduous molars, the orbit and nasal chambers. (Cryer.) This skull shows the mandible developed in advance of the maxilla. An abnormality.

is formed, and we find the upper teeth one-half a tooth buccally over those of the lower."[7]

In examining a half dozen dissections of frozen fetal skulls I have failed to find one case in which the mandible was developed in advance of the maxilla, but, on the contrary, all show this development to be the same as in adult life (Fig. 4).

I firmly believe that the skull Cryer showed is an abnormality, and it only strengthens my previous conclusions that we have abnormalities to contend with prior to birth.

Having observed malrelation of the dental arches as early as the fourth month of fetal life, it will be necessary to consider the factors affecting early malrelations. At the Pittsburgh meeting I dwelt at some length upon the third

cause, namely, mechanical, i. e., amnion pressure. This I will review briefly. Of all the known causes, the pressure exerted by the uterus and the fetal membrane, as a result of a deficiency in the amount of liquor amnii, is undoubtedly the most significant. The damage caused by this condition manifests itself mainly in the extremities and according to the view of Jansen[8] and others, anomalies of the amnion play the most important part in the early production of malformations, and are today considered of the greatest importance.

As stated, it is during the germ-cell period that the first rudiments of the individual are laid down. Surrounding the embryo and within the outer surface is found the liquor amnii varying considerably in amount.

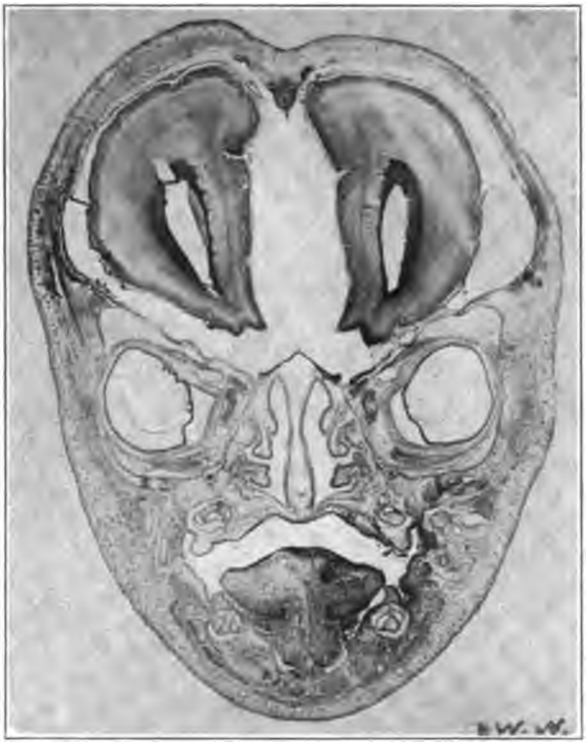

Fig. 4.—Frozen section of a skull cut vertically. Here we find the same relation between the mandible and the maxilla as in adult life.

The study of the mechanical malformations shows that the normal head bend of the fetus is accentuated by external forces or pressure, that pressure on the head curve must push the region of the branchial arches and the future face against the organs of the chest and chest wall, causing the floor of the mouth to approach the roof of the primitive bucco-pharyngeal cavity. From this we can readily see that there is hardly any part of the infolded embryo that is more exposed to the dangers of increased pressure than that in which the branchial arches are squeezed against the chest wall. This pressure interferes with the blood supply, causing a disturbance in circulation, a temporary disturbance in nutrition, and a stunting of growth of the part affected.

The following figures from the above work clearly illustrate the theory of amnion pressure. Fig. 5 shows "mesial section through basis cranii and face of

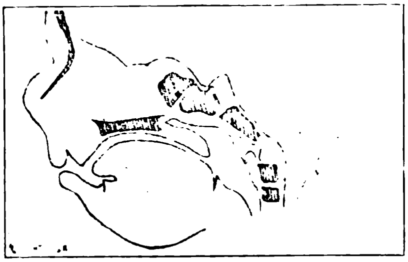

Fig. 5.—Mesial section through base of cranium and face of normal fetus. (Kaufmann, from Jansen.)

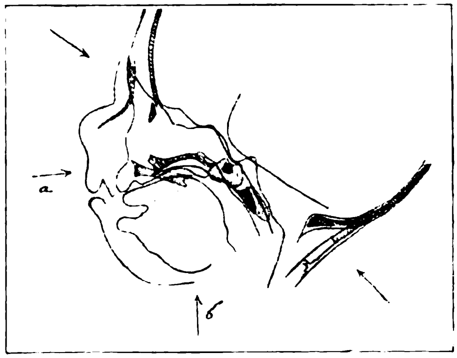

Fig. 6.—Kaufmann's fetus VI laid together with the normal, Fig. 5. Pressure during fetal life has acted in the direction of the arrows *a* and *b*. Light lines are normal, dark are abnormal. The hard palate is displaced backwards and bent.

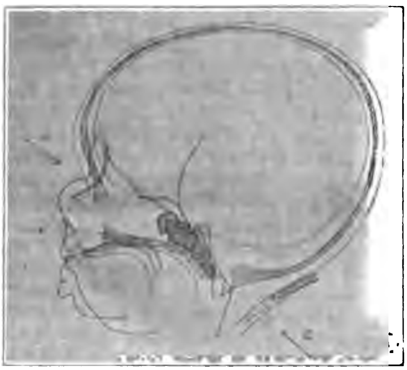

Fig. 7.—Base of the cranium of Kaufmann's fetus I, laid together with the normal (light lines) mandible pushed forward. Pressure here is in the direction of the arrows *a* and *c*.

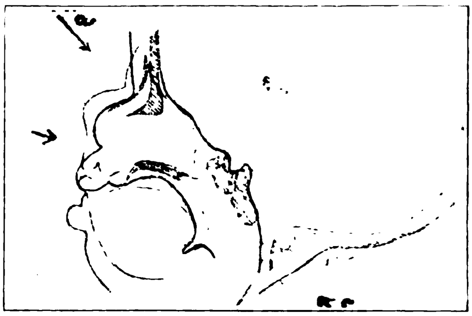

Fig. 8.—A similar condition to that shown in Fig. 7. Direction of the arrows *a* and *c*.

Fig. 9.—Outline of a frozen section in a normal (light lines) and abnormal fetal skull. Pressure here has been in the direction of the arrows *a* and *c*. The base of the cranium is shortened and the mandible displaced backwards, as well as the hard palate.

normal fetus" (Kaufmann) the outline of which is placed parallel to the mesial sections of Figs. 6, 7, 8, 9. In Fig. 6 we find a mechanical pressure has acted

upon the face in the direction of the arrow *a*, which has pressed both the nose and the hard palate backward. The parts of the mouth have been squeezed between the base of the skull behind and some compressive influence in front. This pressure has also changed the direction of the palate; its posterior position has been tilted upwards, so that the angle which it forms with the basis cranii has been made greater than normal, indicating that under the chin a similar mechanical pressure has been at work, in the direction of the arrow *b*. The very same phenomena are visible in Figs. 7, 8 and 9. The sagittal dimensions of the mouth cavity are reduced, moreover the profile line of the lower jaw appears to be pushed inward, showing that an abnormal pressure against the jaws has acted in a backward direction."

The table shown in Fig. 10 admits of a survey of the above facts.

AMNION PRESSURE IS ABLE TO CAUSE:		The mechanical malformations are attended by phenomena of stunting in growth or even of destruction.	During the development of these disturbances the skeleton is in the stage of the:
	mechanical malformations of the embryo:		
during the 1st and 2nd weeks	a wrinkling of the embryonic axis.	destruction of ecto- and mesodermal elements (anencephaly).	mesoderm, 1st stage.
during the 3rd — the ± 6th week	infolding of the embryonic axis.	stunting in growth (achondroplasia).	scleroblastema, 2nd stage.
during the ± 6th — the ± 8th week	Compression or curving of the extremities.	kakomelia in which bones are lacking (hemi-ectromelia, oligodactyly and others).	scleroblastema of the extremities, cartilage and bone of trunk ↗
after the ± 8th week	(The embryonic axis remains intact.)	kakomelia with the normal number of bones (club-foot).	↘ cartilage and bone of the extremities 3rd stage.

Fig. 10.—Table illustrating what amnion pressure is able to cause. (Jansen.)

Mechanical malformations affected by amnion pressure are characterized by two groups of phenomena-interference with growth, and mechanical malformations. Thus we find the region of the dental arches can be either partly or wholly compressed mechanically and the hard palate displaced in the direction of the base of the skull.

Having observed the effects of mechanical pressure on the face, let us now consider a ***normal*** skull. Fig. 11 is the skull of an infant of six months. The deciduous central incisors have erupted and are in occlusion. The position of the mandible is normal.

Fig. 12 shows the normal relation at birth, while Figs. 13, 14, and 15 show a few of the variations found.

That we have abnormal relations of the dental arches at or prior to birth can no longer be a disputed question with a consequent malocclusion of the deciduous teeth.

Now what do the examinations of these illustrations reveal upon close inspection? Hellman reported some years ago "that a great majority of our cases were bottle-fed children and that malocclusion of the teeth is found to be intimately related to conditions that interfere with normal breast feeding."[9] The result of my investigation only strengthens his contentions and proves we must go even further back than this, for bottle feeding is only the result and not a direct cause. A great majority of our patients were "raised on the bottle," but why?

Fig. 11.—Normal skull of infant of six months. Note relation of maxilla and mandible.

Fig. 12.—Normal relation of the mandible at birth.

During development the skeleton is markedly influenced by internal chemical conditions, internal secretions, affecting growth or general nutrition of the body and in some cases seems to be the part primarily affected. This is the next great step in orthodontia that must be investigated and one we will undoubtedly have to undertake ourselves.

Defective bone growth is undoubtedly concerned in a variety of abnormalities of development. A quotation from McCrudden[10] may serve to illustrate.

some of the problems involved. "Another kind of condition in which bone growth is involved is dwarfism. The causes are probably many. But in one type I have observed a disturbance of calcium metabolism associated with improper development of bone. Calcium is almost absent from the urine, leading to the belief that the blood must be poor in calcium or contain it in some unusual combination. The feces are very rich in calcium, containing sometimes more than the food. There is, in fact, a flux of calcium through the feces. And in these cases the long bones fracture easily and roentgen ray examination shows a very thin cortex. In other types there are no abnormalities of this kind. Now, as pointed out by Rubner,[11] we can imagine two fundamental causes for the lack of growth: (1) the lack of what might be called the tendency to grow, that property which is present in young animals, but absent in adults; and (2) the absence of the material for growth. And it seems to me that in these two types we have examples of disturbances of each of these two factors. In the one the skeleton is growing as fast as the material at its command permits. We might also say that it is growing too fast, for it is growing in length at the expense of solidity. In the other there is no such tendency to grow. There is calcium enough present to form longer bones, but there is no tendency to form them. And this kind of disturbance of bone nutrition we may refer to as a quantitative change, for the bones fail to grow in size. There are two large subdivisions of this type * * * one in which the tendency to grow is absent, the other in which the material for growth is not available."

Mendel then states,[12] "There is occasion to believe that the growth of bone in the young is only one of the developmental processes under the physiologic dominance, so to speak, of the endocrine or ductless glands. The thyroid, thymus, ovary, testis, hypophysis and others, furnishing inhibitory, as well as facilitating factors, may be involved. The effects of removal or loss of function of some of these glands upon growth are being investigated in a more systematic manner.

"It will be noted that the interferences with normal growth may be constitutional, or internal, in some of these manifestations of abnormalities of correlation, and external or seemingly associated with alimentation in other cases. It is not yet possible to distinguish clearly between cause and effect.

"It is too early to draw any sweeping conclusions from the already extensive literature on the ductless glands; but one may look forward with confidence to interesting developments in this field of the physiology and pathology of growth. Future investigation may show that directive influences in growth reside in the endocrine glands to an extent scarcely realized at present; possibly it will be found that the correlative factor which has been emphasized in this review is closely bound up, even more closely than can now be appreciated, with the proper growth and development of such special tissues."

Recently Kirk[13] in a paper entitled, "Malocclusion as a Problem in Pathology," quoted from Williams, saying: "That the thyroid secretion is essential to the development of the fetus is shown by several facts. * * * It is normal for women during pregnancy to develop an enlargement of the thyroid

glands, which subsides rapidly after the child is born. By no means the least important function of the thyroid gland is that of fixing the calcium salts in the body. In order to permit of bone formation in the fetus, the mother is obliged to provide more secretion than under normal circumstances she requires, and the gland consequently hypertrophies. After the birth of the child, the increment being no longer necessary, the gland resumes its usual proportions. *In some women this prolonged call of pregnancy has the effect of unduly exhausting the gland, and they are unable in consequence to suckle the child, for lactation is dependent upon a due supply of thyroid secretion.* Such women generally become obese and lethargic, and remain so for varying periods until the thyroid has had time to recover itself. Judicious thyroid medication will frequently not only enable a mother to suckle her infant, but will materially shorten the period of her postpartum difficulties.

"Now with regard to rickets I feel in a position positively to affirm that if all the symptoms of the disease are not due to thyroid insufficiency, then certainly its most salient features are. Especially does this apply to the bony phenomena which characterize its outward seeming. These phenomena are obviously due to inadequate osseous development, and as in the fetus, so in the growing infant, thyroid secretion is essential to the full utilization of the calcium salts. It is known that the bony phenomena are due to a relative absence of calcium salts, and it is also known that these salts, given in large excess though they be, have no influence in arresting the disease. This is because the all-essential link is missing, the thyroid secretion, by whose means alone the ingested calcium can be so assimilated as to be incorporated in the osseous tissues. I claim no originality for this view as to the essential factor in rickets. It was first advanced by Professor Marfan, in 1907, and upheld in an interesting paper which does not appear to have attracted the attention which it deserves. My own experiences have convinced me that this view is correct. If it be true anywhere, as the adage has it, that *Naturam morborum curationes ostendunt,* it is preeminently true in the sphere of opotherapy, and every case of rickets in which I have employed thyroid extract has shown such decided improvement as to leave no doubt in my mind that thyroid insufficiency is the main causative factor in the disease.

"As a child progresses in years, deficiency in thyroid secretion may reveal itself in various ways. * * * In the same connection I discussed the question of adenoids, and made so bold as to suggest concerning them, that they constitute one of the stigmata of thyroid insufficiency.

"Adenoids and enlarged tonsils occur in children who have an inadequate supply of thyroid secretion. The hypertrophic condition in each case is apparently the result of an endeavor on the part of the organism to supply an internal secretion as nearly allied as possible to the one which is lacking. If the hypertrophy is not very pronounced, and if it has not been very long in existence * * * great enough and protracted enough, that is, to produce complications such as disease in the tonsils themselves or in the ears * * * then the exhibition of thyroid extract will cause their regression. It is only

when medical means have failed that operative interference becomes justifiable." This certainly confirms the conclusion of McCrudden.

As to bottle feeding being the cause of malocclusion of the teeth, Hellman later modified his previous conclusion by stating, "Malocclusion of the teeth is found to be intimately related to conditions that interfere with normal breast feeding. * * * It may therefore be concluded that of the numerous factors that enter into the etiologic problem of malocclusion of the teeth, ***internal secretions*** is the one which may in a large measure account for many mysteries that perplex the orthodontist."[14] In discussing Kirk's paper this same investigator states:[15] "Some years ago I began the study of the etiology of malocclusion.

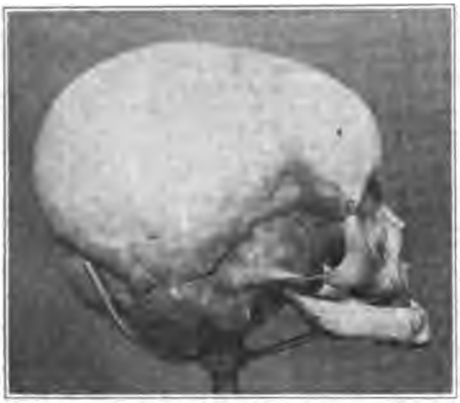

Fig. 13.

Fig. 14.

Fig. 15.

Figs. 13, 14, and 15.—Series illustrating a marked disturbance in development at birth.

I started, as Dr. Kirk said, from the viewpoint of orthodontia. This was done by making the nipple of the bottle-fed baby the bone of contention, but after I had pursued this study for a while, the subject broadened out beyond the nipple, and beyond orthodontia, extending into medicine, and probably into biology. So that the fact of the matter as it stands today is exactly as stated by Dr. Kirk. By experimentation it was found that insufficient thyroid secretion is the cause of disturbances in lactation. This has been proved over and over again by clinical observation also. On account of the inability of the mother to secrete milk and nurse her offspring, most of these children have to resort for their maintenance to the bottle."

We thus find here one of the reasons for the great percentage of "bottle-fed babies." There is one factor, however, we all have overlooked which I believe must be seriously considered before holding the mother entirely accountable in all cases for this condition. This winter I have endeavored to observe in various institutions the relation of feeding to malrelation of the dental arches and I discovered a fair percentage of infants unable to nurse, not on account of the condition of the mother's inability to secrete milk or nurse her offspring, but where the infant was compelled to resort to the bottle to obtain nourishment owing to the malrelation of the mandible preventing proper breast feeding. (Fig. 16, see also Figs. 13, 14, 15.) Whichever of the underlying causes it may be, each has the same common origin.

Falta[16] in his "Ductless Glandular Diseases" shows that the endocrine organs have a direct bearing on the oral cavity and the teeth, we are now only beginning to realize to what extent. He states:

"Disturbances in dentition go hand-in-hand with those of growth of the bones. When the thyroid gland is entirely absent, the children during the

Fig. 16.—In both these cases it was not on account of the mother's inability to secrete milk or nurse her offspring that compelled the use of the bottle, but was due entirely to the distoclusion of the mandible.

first year remain completely toothless. In the latter years the milk-teeth develop very slowly and finally remain partially retained. (Often in addition to the retained milk-teeth are found the rudiments of the permanent teeth.) Here thyroid therapy, as we shall see later, may elicit excellent results.

"Of quite a manifold nature are the findings as to the teeth of cretins. Kranz examined thirty cretins from the Knittelfeld Institute in Steiermark as to jaw and tooth formation, and found numerous anomalies of the jaws, retarded teething, and factors giving rise to anomalies of the position of the teeth. Further, he commonly found alteration of the structure, defects of the enamel, hypoplasias and erosions and very frequently caries.

"Of recent date are the investigations concerning the disturbances in tooth formation. Erdheim first observed that there occurred in rats, one and one-half to two and one-half months after the operation, opaque spots on the anterior surface of the incisor teeth which gradually advanced toward the points with the teeth's growth.

"Erdheim observed a deficient calcification of the dentine. Even the short

cessation of parathyroid function that occurs in autotransplantation of the parathyroid is sufficient to determine the appearance of stripes poor in calcium in the dentine of young rats. A special clinical interest to Erdheim's studies is given by the investigations of Fleischmann. This worker held the view that the defect of enamel so commonly observed was due, not as was formerly supposed, to rachitis, but to tetany. He points to the disproportion between the frequency or rachitis and hypoplasia of the enamel. In rachitis are regularly found alterations in the dentine; in tetany, however, one always finds hypoplasia of the enamel leading to the formation of horizontal transverse surfaces. When frequent exacerbations of the tetany have occurred, are found numerous furrows below one

Fig. 17.—Overdevelopment of maxilla and mandible with marked spaces between the cuspids, premolars, and molars.

Fig. 18.—Similar to Fig. 17 with spacing between all of the teeth, upper laterals missing, both deciduous and permanent cuspids present.

another. Fleischmann investigated ten children who had suffered from tetany and found in all the above mentioned hypoplasia, and indeed this was present only on those teeth that had been present during the course of the illness. Nearly all of the children had also had rachitis. Fleischmann points out, however, that rachitis lasts much longer than tetany, and also attains its acme much later. Fleischmann also finds support for his view in the statement of Fuchs that children with lamellar cataract almost always show hypoplasia of the enamel. In individuals with hypoplasia of the enamel, in whom nothing is known of their having had tetany, there may have existed a latent tetanic condition in early childhood. Very convincing is an observation of Spiegler in a case of recurring tetany that had an attack every spring during eight years. In this case it was

known that the tetany had first made its appearance at the end of the second year of life. All teeth whose crowns must have been formed at this time were normal, while the teeth whose crowns developed later showed defects of the enamel. An entirely similar case was observed by Kahn and myself (Observa-

Fig. 19.—Overdeveloped maxilla and mandible.

Fig. 20.—Increased bone growth in both dental arches.

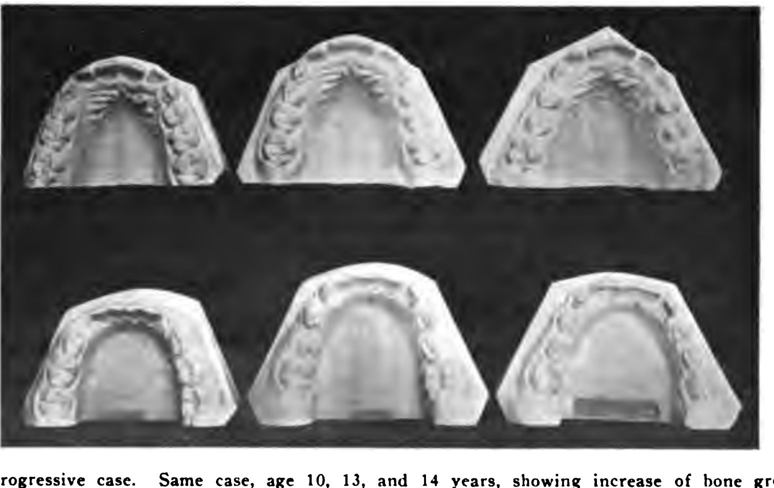

Fig. 21.—Progressive case. Same case, age 10, 13, and 14 years, showing increase of bone growth and spacings between the teeth. Peculiar undersized-shaped premolars.

tion XXIII.) Here were found on the canine and incisor teeth punctiform defects of enamel often arranged in parallel rows; the upper parts of the molars were partly broken off.

"The connection between tetany and defects of the enamel is by all this evidence put on a sound basis; and I shall not discuss the possibility of these defects being brought about by other causes."

The details of the following few cases I will leave for some other paper. In order to bring home to you all this question of internal secretion and its effect on malocclusion of the teeth and to enable you to observe these facts for yourself, I will show you a number of cases from my own practice. I trust all will in the future observe these facts and record them, so that we may arrive at some definite conclusion. Without the help of everyone, those interested in this work will be handicapped, and unable to make much progress.

Case 1.—Both the mandible and maxilla are overdeveloped, with marked

Fig. 22.—Delayed eruption of upper second premolar, 14 years old, due to unequal absorption of the deciduous roots. These delayed dentitions can, in nearly every case, be traced to the same cause. This also shows the increased bone growth in the mandible. Models shown in Fig. 21.

spaces between the cuspids, premolars and molars. Female, age 15. (Fig. 17.)

Case 2.—Similar condition. Missing upper laterals. Upper and lower deciduous cuspids retained. All permanent cuspids present. Female, age 25. Two sisters show the exact conditions. Brother normal. (Fig. 18.)

Case 3.—Increased spacing between all the upper teeth including deciduous molars. Spacing between lower premolars. Female, age 13. (Fig. 19.)

Case 4.—Increase of bone growth in mandible between cuspids and premolars. Female, age 11. (Fig. 20.)

Case 5.—Same case, three years and one year apart. Gradual increase of both the maxilla and mandible. Peculiar shaped lower premolars, upper extremely small occupying half of the space of the deciduous molars. Female,

10, 13, and 14 years. (Fig. 21.) Delayed dentition due to unequal absorption of the deciduous molars, thereby preventing the tooth from falling out. Figs. 22 and 23, a series showing teeth that had to be extracted as they were held in place owing to unequal absorption of the roots. The one on the extreme right is shown in Fig. 22.

SUMMARY

Every case shows an increase of bone growth in the premolar region, with the exception of Case 5, all present an early permanent dentition. Another peculiar fact is that all cases so far observed are in females, with the increase of development taking place at puberty. This is undoubtedly due to sexual conditions, as the period of adolescence was reached in every case earlier than the average girl. We thus find a peculiar association between mandibular and maxillary growth, age, puberty, and sex. A more striking factor and the one that is of the most interest to us is that this abnormal condition showed itself first through the teeth, and upon a thorough investigation established the fact

Fig. 23.—A series showing teeth that had to be extracted owing to unequal absorption of the roots. The one on the extreme right is shown in Fig. 22.

that in all of the above cases one or more of the ductless glands were found to be secreting abnormally.

Figs. 24 and 25 are two skulls of infants about nine months old illustrating a great irregularity in the order of development of teeth. Associated with this irregularity is an abnormal relation of the dental arches. Both skulls show that rickets had been present, and from what has already been described, we know that this disease is now closely associated with the ductless gland.

This illustrates how closely related the teeth are to the other structures of the body and emphasizes the fact that greater cooperation between the orthodontist and the medical profession is necessary if we are to obtain results.

Before concluding I desire to bring to your attention the question of adenoids and tonsils. Here again I believe we are being misled as well as misleading others, by accepting the theory that adenoids and tonsils cause malocclusion and malrelation of the dental arches. We have not studied this question thoroughly enough and have been led blindly into making the above statement. Have we not put the "cart before the horse?" By examining Fig. 26 that if the mandible is in distoclusion the tongue must be pushed upward and backward into the posterior part of the oral cavity thus causing an abnormal pressure in that region especially against the adenoids and tonsils. These organs, having

already hypertrophied through congenital constitutional causes, are increased in size. Whatever the constitutional cause that brings about the distal or mesial occlusion of the mandible, no doubt, also produces a pathologic condition of the adenoids and tonsils, therefore, mesial or distal occlusion or maloc-

Fig. 24.—Skull of infant nine months of age, showing great irregularity in the order of development of teeth, the upper having erupted in advance of lower.

Fig. 25.—Skull of infant about eight months old. Protruding mandible, median line shifted. Upper left and lower right erupted prior to the right and left sides. Rachitic child.

clusion of the teeth is not the result of adenoids and tonsils. Let us once and for all lay aside such unscientific statements and make up our minds that orthodontia is nine parts scientific and one part mechanical. When we do this we will place our profession where it belongs.

CONCLUSIONS

1. Both dental and medical textbooks concerning the dental arch at birth are at present misleading students and are contrary to careful observations.

2. We have malrelation of the dental arches, malformations, and conditions

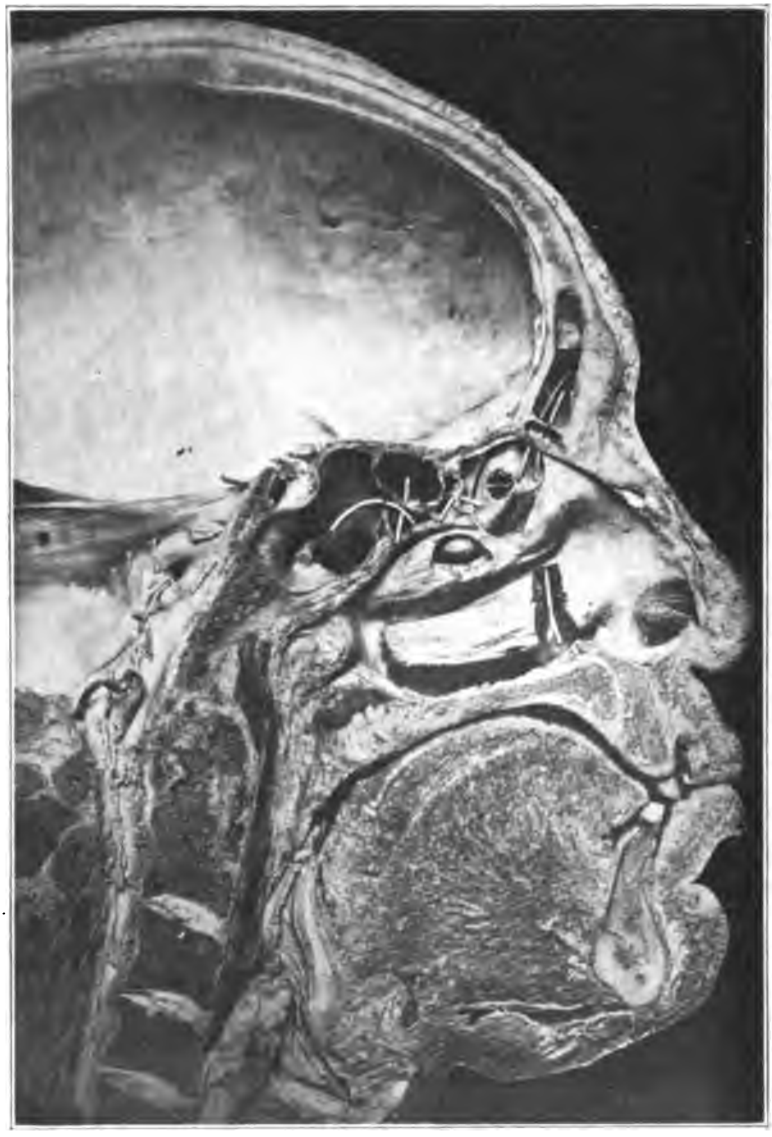

Fig. 26.—Section of frozen skull showing adenoids and tonsils.

to contend with prior to birth, varying in a marked degree. Thus we find malocclusion in the deciduous teeth.

3. A great many early abnormal conditions will, undoubtedly, be found to be the result of mechanical disturbances, the result of amnion pressure.

4. During development the skeleton is markedly influenced by internal secretions, affecting growth or general nutrition of the body, tongue, jaws, and the teeth.

5. In orthodontia we have the question of internal secretions to contend with and a greater cooperation between the orthodontist and the medical profession is necessary if we are to obtain results.

6. Adenoids and tonsils do not cause malocclusion of the teeth, but both are the result, undoubtedly, of the same common etiologic factor.

Therefore, as orthodontists, let us lay aside the idea of our science being nine-tenths mechanical and begin to solve these intricate problems taking place during ontogenetic development. When we do this we will place our specialty among the foremost of sciences.

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DISCUSSION

Dr. W. J. Brady, Kansas City, Missouri.—Mr. President and Gentlemen of the American Society of Orthodontists: It places me at a considerable disadvantage to discuss this paper from the fact that I have never heard or seen anything of it before it was presented to you, and while I must admire the painstaking work of the essayist who has taken such pains to bring this to our attention, I must disagree with him in a number of his findings and as to the material he is working upon. He is away off. It seems very unkind for me to say that, especially to a man who has come so far to give us this contribution in the spirit in which he has given it, and for an outsider like myself who only comes from a city that is within an hour's ride of this city, but that is exactly the way I feel about it.

This question has been before the dental profession, especially the section of orthodontists, ever since I can remember anything whatever about the subject being discussed anywhere, and they all overlook this one vital point in the discussion of the matter; that is, that no matter what the condition is, unless it be such an absolute malformation like

cleft palate or absence of the lower jaw, or some malformation of that kind that is unmistakable, the bones of the face will not stay in the condition they are at the time of birth longer than a few weeks. Nature has her own plan of bringing those to their full growth, and it is well that it is so because the human being may start out in life with the bones of the face very much misshapen. If we were to examine case after case, we would find that is the rule, not the exception, and they manage to reach a reasonable degree of maturity, a reasonable degree of saneness, through the treatment we advise. Why? Nature has made her plans whereby these seemingly malformed cases may be straightened out, and in this we overlook two important things, that is, the effect of use upon these jaws in their development. Most malformations do not begin to develop until the temporary teeth are in place and there begins to be a considerable usage of these teeth; I do not say all of them, but the majority of them that we meet with in daily practice. They do not begin to develop until there are some teeth to begin operation upon. The bones of the face have their rules of development apart from other bones. Other bones have their rules of development apart from still others. The cranium gives proper development according to the growth of the brain. We used to think that in some way the brain did not develop as it should, and therefore the brain was restricted, but it is the other way. In case there is no brain tissue developed, the cranium does not develop together with it. In the case of the bones of the face, the thing that develops them is their use, and if that use is given as nature intended, the stimulation of pressure upon the bones from the use of the teeth develops them almost to normal.

We get a wrong view of these things at times. We imagine that the general run of the population have malocclusion, but the fact of the matter is that there is a small proportion of the population of our country that have any particular degree of malocclusion. If you go out and begin to go around among the schools of the four classes, among the people where there are different classes, you begin to open your eyes if you are not so prejudiced that you will not see these things. I can see things outside the walls of my office, and I have discovered there is no such number of malocclusions as I had supposed there were. In the reform schools, where we get the product of the dregs of the community, there we supposed we would find every sort of trouble in the way of malocclusion that could be found, and yet, to my great astonishment, when I investigated cases of that kind I found they had the finest kind of dental arches and malocclusion was the great exception. So we do not find cases of malocclusion as frequently as we have been prone to believe, and it is because Nature manages through her processes to bring about normal development of the bones of the face a great deal oftener than we think.

Now, in malocclusion there are two causes that stand out above all others, and they comprise fully ninety per cent of all malocclusions encountered any place, anywhere, and at any time. The first fifty per cent of this ninety is caused by adenoids and bad tonsils. In spite of our friend's belief, it is the other way, but this particular form of malocclusion is not found unless the adenoids are there first. We have been mistaking a symptom for the cause. It is exactly the other way. Malocclusion is not the cause of anything; it is the product of something, and bad tonsils and adenoids are the cause of fully fifty per cent of the cases encountered. The forty per cent more are caused by disuse, meaning a lack of usage of the jaws and associated tissue. We have learned that through the force of circumstances certain people are compelled to use their teeth; that their jaws develop to the full size; that the dental arches assume normal forms; and there is no use for an orthodontist in that country. If you go to the museums and see and examine the skulls from various parts of the world, and notice the character of food on which these people lived, you will find in those that came from the north among the Eskimos, and lived on food uncooked, and chewed it thoroughly, the jaws developed to accommodate the teeth, and malocclusion is comparatively unknown. If you examine the skulls that come from the southwest among the American Indians, you will find they lived on jerked beef and corn and perhaps gnawed bones, and the Indian boys and girls took away these bones from the dogs to get them to gnaw; their jaws were well developed and full size. We find the jaws grow and develop by usage. Usage is an immense factor in the development of the jaws, and it is the thing that brings about the great number of full developments or practically normal developments of the jaws in this country which we do not realize are in existence because we do not see them.

I realize that what I have to say in discussing this paper is rambling and not as carefully prepared as the paper which the gentleman from New York has given us, and yet such

as it is, I want to give it to you and leave with you these thoughts that perhaps this idea of prenatal influence we have been prone to believe in is not exactly the thing after all, because personally I have no faith in it. I have never seen any indication which would lead me to believe that it was responsible for only a few malformations. So far as our every day practice is concerned, we do not see these malocclusions or malformations as frequently as the doctor would have us believe, and I hope Dr. Weinberger will not consider anything I am saying as personal. In short, the doctor has given us an admirable presentation of the forces at work causing malocclusion and malformation, and I admire him for bringing this subject before us, and while I must disagree with him as violently as I do, yet I hope that we will not be carried away with the idea that this belief amounts to any great thing.

The belief that prenatal influence has a most wonderful influence over the growth and development of human beings is as old as time; but that does not mean, however, that it necessarily has any scientific foundation. No belief necessarily has to have a foundation, much less a scientific or sensible foündation. Most of the beliefs we have are due to our ignorance or prejudice rather than to any real knowledge, and because that has been the belief for so many years, is no reason why it has anything back of it. There are many other things that have been believed and are yet believed in spite of the fact they are true. There is not a dentist who has not been asked every year the question of whether loss of the eye teeth will not cause trouble with the eyes and cause blindness, and whether a great many things of a similar character may not occur if such and such is done with certain teeth? The belief has nothing to do with the facts in the case. So the belief that prenatal influence can exert any particular influence over the growth of an individual outside of an unusual case does not necessarily have any foundation.

Dr. B. W. Weinberger.—I appreciate what Dr. Brady has said and the spirit in which he has given it, but I can not agree with his idea of looking at it from his standpoint.

As to his comment on not receiving my paper, thereby preventing him from going over it before the meeting, had I been notified I might have forwarded him a copy. Until I saw the program this morning I was not aware as to who would discuss the paper. I believe it is up to the executive committee to notify an essayist, so that copies might be forwarded.

Had Dr. Brady received a copy, I firmly believe he would not have assumed the attitude he has taken. We have malformation prior to birth, this fact can not be disputed any longer. To say that science does not recognize prenatal influences is assuming too much. The sooner all of us realize this, just that much nearer are we to our goal. How large a percentage of abnormalities we have at that age no one knows. In going through the hospitals in New York, out of hundreds there were not more than a dozen well-defined cases, so that the percentage is small, but we have definite malformations at birth.

There is no question but that prenatal influences are having a peculiar effect and it is being investigated by men connected with diseases of children, infant feeding, and so on. These men have tried to determine why children have to be taken off the breast and put on the bottle. As explained in my paper there are infants who can not nurse from the breast, due to the distal relation of the mandible, so there must be something back of prenatal influences. Then, how about those cases reported with increased growth of the maxilla and mandible, as well as those cited from various investigators showing the effect on the teeth?

THE CONCEALED LABIAL ARCH WIRE WITH SPRING EXTENSIONS*

By Lloyd S. Lourie, D.D.S., Chicago, Ill.

It was a mistake that my name appeared on the program for a paper, as I had intended to give only a table clinic, allowing the appliance to speak for itself. Yet it does involve important principles in appliance construction, which may be worthy of discussion before the society. I regret that my illustrations are not more comprehensive, due to the fact that they were collected after the printed program was received, and when many of my patients were away on vacations.

For best results mechanically and physiologically, force should be applied to a tooth only in the direction in which it is desirable for it to move. For that reason, appliances should be so constructed as to allow individual tooth

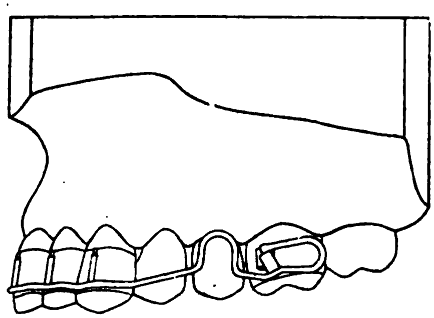

Fig. 1.

movement, without undesirable reaction on adjoining teeth, and with the minimum of change in the reaction on anchor teeth. Angle has emphasized this point, and rightly criticized the use of spring loops, because of constantly changing direction of force. In Dental Cosmos, September, 1916, speaking of vertical loops (Fig. 1) in buccal portions of arches, he says: "My criticism is that instead of the force being delivered evenly to the anchor tooth and *in one direction only,* as is easily possible with the screw, the direction of force is constantly changed, thus mischievously disturbing the function of the cells of the peridental membrane and the alveolar process. And this must be repeated with each change in the form of the loop."

Later he limits this criticism to vertical loops in buccal portion of the arch, attempting to whitewash the same objections in horizontal loops in other portions of the arch, which are so extensively used in his pin and tube and ribbon arch appliances (Figs. 2, 3 and 4). However, I submit for your consideration the suggestion that spring loop reaction is much the same whether in vertical or horizontal plane. Also, that the various arch bends and twists by which

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 7, 1917.

Fig. 2.—Angle's pin and tube appliance. (Ketcham.)

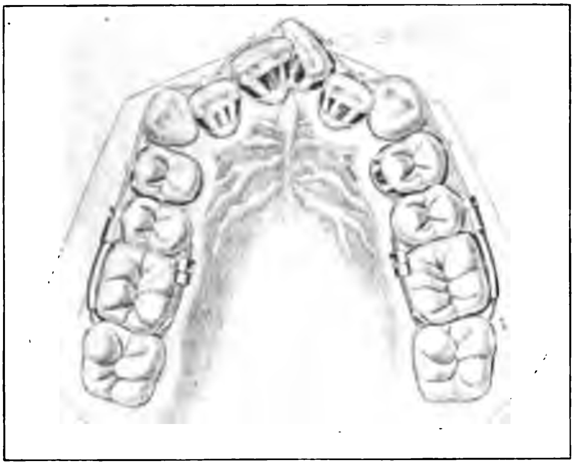

Fig. 3.

Fig. 4.—Angle's ribbon arch adjusted to the teeth.

Fig. 5.—Robinson's alignment wire with blocks in seats.

Fig. 6.

Fig. 7.

force is applied in the above mentioned appliances and the Robinson appliance (Fig. 5), or any other of the same principle of force delivery, are but modified forms of spring loops and subject to the same criticism. In all of them where

Fig. 8.

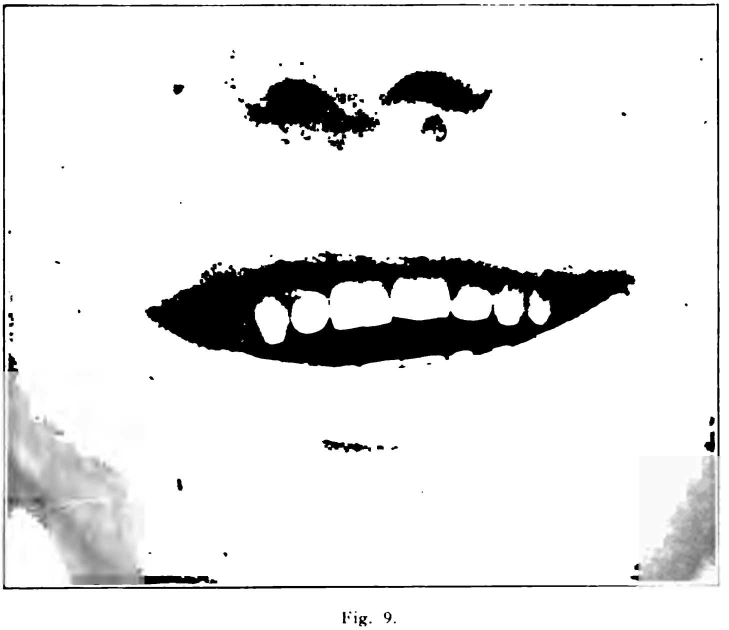

Fig. 9.

several adjoining teeth are being moved, the only possibility of individual movement is in the section of arch between the adjoining teeth. The spring pres-

sure for moving one tooth must react on the adjoining teeth, before it can react on the main anchorage. Sometimes this is desirable, but often a great disadvantage. Furthermore, with all thin or small gauge arches, there is increased danger of injurious changing reaction on the main anchorage by bending of the buccal portions of the arch. This may be controlled by a supplementary lingual arch. In fact, I believe it good practice to use such a lingual arch for

Fig. 10.

Fig. 11.

Fig. 12.

increased stability of anchor teeth wherever they are to be subjected to much force.

The appliance that I will describe is not claimed to be of universal application, nor does it "meet every hygienic and physiologic need," but I believe the principle is correct, I have used it successfully in a variety of ways, and I feel that its usefulness can be greatly extended.

The appliance consists of a comparatively rigid base wire (Fig. 6), preferably adjustably attached to anchor teeth, and small spring extensions for

delivering force for individual tooth movement. The form of attachment of base wire to anchor teeth depends upon requirements of the case. The base wire lies beyond the teeth gingivally, but does not touch the soft tissues underlying it, and is usually hidden entirely by the lip (Fig. 7). The springs may be of various forms and sizes (Figs. 10, 11 and 12), the simplest being the straight vertical one (Figs. 6 and 7). This may be used to press against a tooth or to pull on it if attached by ligature. The end of the spring may be a point, knob, eyelet, or incisal hook. The one possessing the most varied possibilities is the recurred vertical spring (Figs. 8 and 9), the recurved end entering a vertical tube on the banded tooth. With this spring, the tooth may be moved in any advisable direction or combination of directions, including root movement and rotation, excepting for extrusion or intrusion (Figs. 10, 11 and 12). These latter movements may be provided for by adding a horizontal section close to the base wire, or by utilizing the spring of the base wire itself, if that would not react unfavorably on the other teeth being moved. The end may be locked in the tube or allowed to move freely if required. The vertical springs should be used wherever possible, for hygienic reasons (allowing use of toothbrush and floss) and particularly in the front of the mouth for esthetic reasons, as they harmonize with the lines of approximal contact of the teeth (Fig. 7); whereas. the horizontal extensions contrast and are more conspicuous.

By using the appliance in combination with a lingual arch, in many cases teeth may be moved as desired without the use of either bands or ligatures. In fact, by applying the same principles, much can be done with the lingual arch alone, the horizontal spring extensions being more adaptable, however.

In closing, let me emphasize that the force for individual tooth movement should be controlled in the individual spring extension, the base wire being used as anchorage for these reactions, and for movement of teeth in groups, and for intentional movements of anchor teeth.

DISCUSSION

Dr. Martin Dewey, Chicago.—In discussing this paper of Dr. Lourie's I can only add my support to what he has said in regard to the use of this appliance, and, to a certain extent, call attention to some things he has mentioned regarding the deficiency of other styles of appliances.

It seems that regulating appliances have passed through evolutionary stages, and while some of the changes made in the construction of appliances have been progressive, other steps have been backward. Any regulating appliance to be successful must possess certain requirements, and I think you will find that this appliance as used by Dr. Lourie possesses more ideal features than any other style of appliance that has been brought out.

One thing which I want to call attention to is the subject of anchorage. If you remember the literature of a few years ago, when the question of bodily tooth movement was extensively advocated, attention was called to the fact that we had to have firm anchorage. The pin and tube appliance and ribbon arch are appliances composed of flexible alignment wires, which control both the anchorage and the moving force. As a result of this you are apt to have more or less trouble with the anchorage. You take a small gauge arch, such as a ribbon arch, bend it around in the various positions it is to occupy when attached to the malposed tooth, and it exerts a force on the anchor teeth that is hard to control, as you have all sorts of reactions that are influenced by each adjustment you make to the malposed teeth. If you attempt to bend the ribbon arch to exert force on one tooth, and have the arch attached to the proximating teeth, you are

bound to have a reaction on the proximating teeth, which shows the individual tooth adjustment is impossible.

Mention has been made of the fact that the lingual arch can be used to increase the anchorage of the molars. In using the concealed labial arch or labial alignment wire which is constructed of rigid wire with spur extensions, to a certain extent you divide the appliance into two parts: your base wire becomes your anchorage and the spur extensions your moving apparatus. Individual tooth movement is controlled by individual springs. If you bend one of these individual springs, whether it is adjusted to a band or in contact with the tooth, you know you have all pressure on that individual tooth. It does not affect the approximate tooth only as the force is reactive to the base wire, and the individual spring extension should be so delicate that it will not disturb the base wire. You will also have very little danger of changing the molars bucco-lingually because of the rigid base wire.

There is not very much more I can say except to call attention to some of the deficiencies in other styles of appliances and to some of the advantages which Dr. Lourie has passed over and has not impressed upon you sufficiently. In any style of appliance that consists of a small gauge wire rigidly attached to the moving teeth, and the appliance is adjusted from lateral to central and over the canine and around the molar, in attempting to change the shape of the alignment wire you get so many reactions on the malposed teeth that you do not know what is happening to the anchorage. These reactions are absolutely impossible for the average man to figure out. When you have the teeth attached rigidly, you can not adjust the appliance on the central incisor without reacting on the lateral. With a spring or a pin that is short, you lose the elasticity of the pin, or the elasticity is interfered with by the stiff alignment wire. As a result of this when you have force exerted on the central it will be reacting on the lateral and vice versa.

From the hygienic standpoint, the advantage of Dr. Lourie's appliance is easily seen. We can use a toothbrush or floss silk successfully. Those of you who have seen some of those "late" appliances in the mouth know that they look like the front window of a hardware store, and they accumulate everything that can be found in the average garbage can. The ribbon arch possesses the same disadvantage as the pin and tube appliance from the standpoint of application, only more so. You have greater trouble in making adjustments because of the impossibility of bending the flat wire with any degree of certainty. Owing to the difference in the thickness of the ribbon arch occluso-gingivally as compared with the thickness bucco-lingually, it is impossible to make a bend occluso-gingivally and have the same degree of spring or action that you would have bucco-lingually.

As regards the action of the loop which has been mentioned, the loop in the wire always changes its shape and always exerts a tipping influence if the appliance is attached rigidly. In those cases in which you use it, if you start to adjust the appliance on a lateral, something always happens to the appliance in the molar region. As you increase your bends or loops bucco-lingually, you increase the complications of the loop bucco-lingually, which is just as troublesome as a loop occluso-gingivally. If the attachments in these appliances were not so rigid, the objection would not be so apparent. If you use a wire ligature in an appliance that has loops in it, you will not get as unsatisfactory results as you would with a rigid attachment because of the movement between the wire ligature and the loop in the appliance.

Let us take the appliance that has been exhibited. Dr. Lourie has called our attention to the fact that the base wire must be placed gingivally, but he did not mention the height at which it should be placed. In this you are governed by the attachments of the lip. Of course, the higher you have it placed, the longer the spring will be. In the molar region the height will have to be governed by the attachment of the anterior portion of the buccinator muscle or the posterior portion of the levator lábi menti. As a result of that, the wire must not be so high as to interfere with the attachment of the lip. In some cases where the frenum is low, you can make a bend in that region to avoid interfering with the frenum. If it interferes with the action of the muscles of the lip you will have trouble. With the spurs attached to the lateral incisors, you have the advantage of individual tooth attachment without disturbing the base wire. You do not have that with the pin and tube or ribbon arch or similar style of wire.

Dr. Abell asked Dr. Robinson a question which I think to a certain extent might be

mentioned here, with reference to the expansion of the molars. You take these small gauge wires and as a result of the reaction which you get from the incisors, it is difficult to control molar anchorage. The more attachments you have in the incisor region with a small gauge alignment wire, the less you will know what is happening to the molar. The action of the ribbon arch is unsatisfactory in this respect.

One of the most important things to remember in connection with the application of this appliance is that of esthetics. We find patients will wear any kind of appliance at first, but after a while they begin to object to the appliance on account of its being so conspicuous, and if the appliance is inconspicuous we will have less trouble. A youngster who wears a conspicuous appliance is not only annoyed himself, but he annoys his parents and friends. People get tired of seeing his mouth full of bands and conspicuous material. These spurs or spring extensions are almost invisible and contain such a small amount of material that they can be used to great advantage as retaining appliances as well as regulating appliances. In a great many instances, after a case is treated and the teeth moved, it is hard to devise a retaining appliance that is less conspicuous and has less material than the regulating appliances you have on. That is a great advantage because we know sometimes we are not able to retain patients as soon as we would like. They say, "I am going somewhere; I am leaving for a vacation." The time is short. You can not change the appliance, but if you have one like this on, they can go because your regulating appliance is also a retaining appliance. It saves a great amount of time, and it is a source of great satisfaction in a large orthodontic practice.

Finally, I honestly believe there is no other appliance which possesses so many desirable features, both from a mechanical and esthetic standpoint, as this appliance does. The patient derives great comfort and satisfaction in wearing it, and as compared with some others it will compensate you for the extra technic necessary in constructing it.

Dr. W. H. Ellis, Buffalo.—When Dr. Lourie speaks we always get something good, and today is no exception. His introduction on the subject of dynamics is very clear and the observations correct. In my opinion, however, we still have use for spring loops in many cases. I find them of advantage, particularly in appliances designed for the development of deciduous arches. I agree with the essayist when he says that "spring loop reaction is much the same, whether in vertical or horizontal plane." In principle it is somewhat the same as when applied to round arch wire of the metals as now used in orthodontia.

It seems to me, that the contraindicated and unlooked for reactions can usually be eliminated and the results justify their use. This involves, of course, very careful predetermination of the form and extent of the loop bends, so as to put the force in only the desired direction. The arch wire should be of fine gauge and only a minimum amount of pressure exerted at each change,—only an amount that will stimulate a normal development.

Dr. Lourie has, indeed, given us a valuable appliance, particularly so for esthetic reasons and its efficiency. It is an appliance we shall all gladly make much use of.

The thought comes to me that the position of the arch wire farther up under the lip will be likely to cause less distortion of the lip than the usual position at the gingivæ.

This appliance shows us that we are rapidly approaching the ideal technic, one that is esthetic, inconspicuous, and simple. This appliance exerts gentle force only where indicated, and, at the same time, allows for that individual tooth movement so necessary physiologically.

Dr. Calvin S. Case, Chicago.—One of the most encouraging things that comes to my mind in regard to the presentation of these two papers that we have listened to this morning is the fact that we are not confining ourselves to any one single method; and that we are now willing to accept other methods. Another thing is it requires the orthodontist to do a great deal of the technical work himself, which enables him to apply the proper forces and make changes in variation that are especially adapted to the particular cases in hand.

I have been somewhat acquainted with Dr. Robinson's method for some time, and have thought a great deal of it. I think there is a great deal in it that is valuable, but, of course, it will not do for all cases. I am now very much pleased to hear Dr. Lourie's paper and to learn more of that which he has from time to time given me ideas regarding. I consider it a very valuable method, and one that will prove to be more and more valuable in practice. It is certainly very desirable to have our appliances as inconspicuous as

possible, and if the forces can be applied by this method safely and according to mechanical principle and physiologic needs, it is certainly exceedingly valuable. I do not know enough about it to really talk in regard to it, but I am interested to know more, and will endeavor to study the forces that he expects to obtain from it.

Dr. G. W. Grieve, Toronto.—I would like to suggest that Dr. Lourie, when he closes the discussion, give us a little more idea of the technic of the composition of this labial and lingual arch, and give us a clearer presentation, if possible, on the use of his positions of lingual wire and the extension.

I certainly have appreciated very much the presentation of this subject by Dr. Lourie. I have had the pleasure of getting good results from the use of the lingual arch as used by Dr. Lourie, not fixed, as Dr. Lourie uses it a great deal, but as a removable appliance.

I am happy to have heard this paper.

Dr. R. Ottolengui, New York City.—I want to say a word or two in regard to this paper. We have had presented to us in an altogether too abbreviated manner a method which appears to be one of the most important that we can use. Dr. Lourie and Dr. Dewey in presenting to us the advantages of this appliance have used the same slides repeatedly and have expressed these advantages most accurately, but we find the labial surfaces of the anterior teeth are all in normal alignment. This is not a malocclusal position. There are no malpositions to those teeth. Frequently patients come to us with nearly all the teeth in torsiversion.

It seems to me, we are not going to find it so easy to get away from the use of bands if we use rigid base wire above the arch and depend upon a pin to rest against the slanting surfaces of the teeth. I do not know that I make myself perfectly clear to you, but I have seen this appliance before, and you will observe the only case that was shown concerned the anterior teeth wherein the malposed contained bands. A question arose in my mind in the actual treatment. I do see how, as a retainer we have a very esthetic and inconspicuous appliance because of the absence of bands. I do not think the essayist has made it clear to us how to get rid of bands where the teeth are in malposition, and especially in torsiversion. That is more, however, in the form of a question rather than a criticism, because I fully appreciate Dr. Lourie's great ability.

Dr. L. S. Lourie.—Dr. Grieve wants a fuller explanation of what I have said, and so does Dr. Ottolengui. Much of what I have said, in this short paper, has been presented by Dr. Dewey in the form of an article. I have not felt that I had time to prepare a paper that would cover the matter in such great detail as I would like to present it. However, I am willing to go into the matter in greater detail if the society so desires, and answer other points which were brought up.

Dr. Dewey mentioned the advantage of looping the base wire on account of the frenum. I want to suggest that while that is an advantage, if there is going to be any particular use of the base wire for exerting changes on the anchor teeth, there will be the same objections previously made to loops. So I believe the fewer bends and loops you have in the base wire, the better. If it is a patient who has a short upper lip, such a loop might be used in spite of the above objection to it. No appliance fills every need. When we select what we think is best for a case in hand, it is a compromise. We select an appliance that has the greatest advantages and fewest disadvantages.

Dr. Ellis says he still has use for spring loops, and I have no doubt we will use them at times, recognizing their limitations, however.

I indorse the opening remarks of Dr. Case, it is a good sign that we are all willing to accept other men's ideas, and not say that whatever ideas we have can not be improved upon as some have advised.

Dr. Ottolengui.—Can you handle teeth in torsiversion without bands?

Dr. Lourie.—I can correct teeth in torsiversion, in a great many cases without bands. It depends to some extent upon the shape of the teeth. Take a tooth that has broad flat surfaces, where I can get the labial extension far enough off the center of the tooth to get leverage and have a fulcrum formed by the lingual appliance, I can correct it.

Dr. Ottolengui.—In conjunction with the lingual arch?

Dr. Lourie.—Yes.

Dr. Ottolengui.—Is it (the lingual arch) necessary? If you bring the spring extension to the correct point labially as the pressure continues, you fit the tooth; you rotate it to a certain extent.

Dr. Lourie.—A certain amount of rotation may be accomplished with the labial spring alone. In this paper, there is no description of the lingual and labial arch combination as that has been previously covered in articles by Dr. Dewey. I was presenting a new thing, the recurved labial spring extension with band and tube which may be used for various tooth movements instead of the combination of pressure lingually and labially. As I have said, my first choice is a lingual arch; my second choice is a combination of the lingual and labial arches without bands, and my third choice is something of this sort, if I wish to get quicker results with less frequent appointments, or have more certain control over my work.

In a particular case shown here, I started the treatment with the lingual arch but discontinued it, the child having considerable defect in speech, and the mother was inclined to believe, as most people would naturally, that the lingual bar had something to do with it or prevented its correction. My experience with lingual bars is, that if they are placed right and allowed to lie in the rugæ of the mouth, they do not interfere with speech. I would have continued with the lingual appliance, but I decided I would not put myself in a position of being criticized for in any way preventing that child from developing correct enunciation. So I adopted this labial appliance. I could have accomplished rotation of the laterals, carrying them out to normal position, with root movement by a combination of labial and lingual arches without the use of any bands. I am presenting this labial arch with recurved spring extensions because I believe it will require less skill and careful adjustment to accomplish results than the use of the combination of arches. There is nothing patented about it, and you have perfect liberty to modify and amplify it to suit your individual needs.

Dr. Case.—Will you explain the intruding and extruding forces, acting on a portion of a tooth?

Dr. Lourie.—There is one illustration which shows a cuspid being extruded (see Fig. 12).

Dr. Case.—There is a band with a horizontal spring. You must have force directing in that way to correct the alignment of the teeth.

Dr. Lourie.—Yes.

Dr. Case.—I wondered how you did it.

Dr. Lourie.—You can use the labial arch with the extension; you can put horizontal extension to the vertical extension and get a spring that is up and down.

Dr. Case.—By having the loop in the small section attached to the base wire?

Dr. Lourie.—Not a loop, a right-angled bend. You have it attached here (indicating) and go over there from the base wire and bend down. That gives vertical action without direct action of the arch, without transmitting force to the adjoining tooth. Dr. Ellis has suggested that arches placed as these are placed would interfere less with the lip. I have tested this out by clinical experience and find patients do not object to it. An arch placed across the teeth is where the tip of the lip is moving and it is in the way. Some patients who have changed from the old one say, "I don't care how long I have to wear the new one, it does not bother my lip." In cases where there was a deficiency in the function of the upper lip, I have taken off the labial arch to test retention and mothers have said, "I wish you would put that back, for the lip was held down better with it on." If the arch is across the teeth, in smiling, it is uncovered and the lip rests above it. When the arch is above the teeth the lip is pressing over it all the time and more easily develops normal function.

Dr. Federspiel.—Is there any irritation of the epithelium of the lip?

Dr. Lourie.—I have not had any. That is another reason for not making the base wire too small. If you make it too small, the lip falls in over it and irritation results. You must be careful how it is adjusted. If it is allowed to extend out from the gum at any particular place, you are bound to have lip irritation. As I have mentioned, this must be adjusted so that it does not come in contact with the soft tissues underlying, otherwise you occasionally have some pressure on the soft tissues, and you must adjust it to allow for changes due to erupting teeth, particularly the cuspids. If you are not particularly watchful, the gum will press up against the base wire and you will have trouble.

Dr. Ottolengui.—Is the appliance removable?

Dr. Lourie.—Yes. The labial base wire is removable. The attachment is a horizontal tube with the nut in order to adjust it mesio-distally. It is possible to use plain wire, bend it at right angles upward and forward and get more or less mesio-distal adjustment in the

buccal portion of the arch, but you have to make compensating bends, and each bend affects the fit of the labial portion of the arch.

Dr. Grieve.—Does the horizontal tube have a nut at the distal, as well as at the mesial end?

Dr. Lourie.—No, I use a horizontal tube with a nut at the mesial end, and a silk ligature tied in front of the nut and distal to the tube. My reason for that is as follows: I tell my patients, with the utmost confidence that they do not need to have sore teeth; that soreness is an indication that I have not my appliance under control. If I can not get the appliance under control in the first adjustment, I can generally do so in the second. The teeth may be a little sore because they have not become accustomed to the pressure, and I would rather make use of an appliance that can be removed by the patient, if necessary, than have the patient spend a night with sore teeth. If one of these extensions should get broken off or bent at any place, there might be undesirable pressure upon some of the other teeth. So I tell them that if the appliance is bent or injured in any way, I would rather have them cut the silk ligatures which I tie in front of the nut and back over the tube. As Dr. Dewey mentioned, the use of the appliance may be continued without change for retention. However, to eliminate bands, it is necessary to use a lingual arch for a fulcrum and the labial arch with extensions to control the rotation and root movement. This may not be effective in every case, particularly if complicated by intrusion or extrusion.

Retention can be developed from a moving appliance, by removing the band and the recurved portion of the spring, which leaves a simple vertical spring extension. This may be bent, so that the end of the spring comes in contact with the most desirable point on the tooth for control. If this is not effective, all that is necessary is to replace the spring extension and band, as no change has been made in the remainder of the appliance.

After the appliance has been worn continuously for some months as a retainer, small hooks are added so that rubber bands can be used instead of silk ligatures for holding it in place. The patient may then take it out for short periods. Young ladies appreciate this privilege for special occasions. That is the first step. Then, when I think the teeth are firm enough, the labial arch may be left out during the day, provided that when it is out it is placed on a form such as I have illustrated (*Dental Items of Interest,* January, 1916). That is done for two purposes, one of which is to prevent the extensions from being bent while the appliance is out of the mouth, and another one is that the patient can know if it has been bent while getting it out or putting it in. It is brought in for readjustment if necessary. It is not a bad idea to have two of these forms, one in the office so that it would be less work to reconstruct the appliance in case the appliance and one form should be lost.

Dr. Federspiel.—What prevents the molars from tipping?

Dr. Lourie.—Use the same precautions to prevent straining the anchorage in this appliance as in any other. You can reinforce the molars by attaching additional teeth, as Dr. Case did in his appliance. I reinforce the molar anchorage in a great many cases with lingual arches which may have no other use, though they may be used later in combination for retention. The lingual arch is extended forward, and fastened to the bicuspids with ligatures or bands with lingual extensions to prevent tipping of the lingual arch. The lingual arch is the reinforcing lever and counteracts the tipping tendency of the labial arch.

Dr. Ottolengui.—I would like to ask Dr. Lourie how he prevents extensions from slipping up.

Dr. Lourie.—I mentioned that in my original presentation. (Hooks over incisal edges if bands and tubes are not used.)

A Member.—Do you use this appliance on all patients in temporary dentures?

Dr. Lourie.—I do not believe in using such an extensive appliance for temporary dentures as a great many men advise, because by the time a deciduous denture is expanded, frequently the teeth and expansion will be lost any way. It is just as important to keep a deciduous denture in good solid condition so that the child can masticate thoroughly with it, as it is to attempt to get some effect upon the permanent denture by mechanically expanding the deciduous one.

A Member.—What about the other extreme?

Dr. Lourie.—There are many cases in which all that is necessary to do is to expand enough to allow the incoming incisors to take their positions in the arch. Naturally widen-

ing of the rest of it will follow. My plan is to assist in developing cases where it is necessary.

A Member.—What is the extreme age of patients on whom you use this appliance?

Dr. Lourie.—It depends upon what you are going to undertake. The limitations of age would apply equally well to any other appliance.

It has not been my desire to give a talk on the use of my lingual arch and wire stretchers because I feel it is something I developed especially; and while I am getting results I can not explain the details and dangers of it fully enough to warrant you in trying to extend its use. I probably had better not tackle that phase of the subject, but after I came to use the lingual arch and enlarged it with my wire stretchers, I found that was the most direct and simplest force I could use. If the pinch is made straight, it corresponds to a jackscrew, and you have the lingual arch lengthened in the direction of the portion pinched. The arch can be lengthened mesio-distally by pinching the lateral portions and can be widened buccally by pinching the incisor portion, and in many cases that is all that is necessary. There is a disadvantage, in that the action is limited, but I believe that usually I can get movement as rapidly as is advisable. I also use a lingual arch with spring extensions. The same thing applies as to the labial arch, the fewer bends and kinks you put in, the better, because of the reaction. I prefer a lingual arch that does not come in contact with the teeth or soft tissues, with spring extensions for getting movement of the teeth, later, if necessary, using a combination of lingual and labial arches for finer adjustment.

A Member.—In using a lingual arch do you use a round or oval tube?

Dr. Lourie.—The form of attachment depends on the case.

A Member.—Do you mind saying a few words about the materials?

Dr. Lourie.—I have not found anything that compares with iridio-platinum for use with wire-stretching pliers. It has a compressibility and ductility together with rigidity that I have not found in any other material. The labial base wires I have used mostly, have been 17-gauge platinum gold expansion arches, with 22-gauge platinum gold spring extension. With this I have had more or less spring through the action of the base wire itself, because the 22-gauge spring was really so stiff, comparatively, that it reacted upon the base wire. But more recently I have used 19-gauge iridio-platinum base wires and 24-gauge platinum gold for these extensions. Where it is a plain spring and not recurving into the tube, I have tapered down the 24-gauge spring until the lower half of it was not more than 26-gauge. That is as thin as I have used it. You can use 26-gauge for recurved extensions. I have not used it because I could get only the larger tubes.

Platinum is not springy enough for the extensions. The particular grade of metal you use is important. The point is that the base wire should be comparatively rigid, while you want as great a range of spring in these little extensions as you can possibly get. If any one can tell me of something that has more spring to it, I would be glad to hear of it.

AN EXPERIMENTAL STUDY OF ROOT-FILLED TEETH: PRELIMINARY REPORT

By M. B. Cohen, M.D., West Salem, Ohio

SINCE the epochal work of Billings and Rosenow, many diseased conditions have been traced to focal infections in the oral cavity; clinicians have learned that the mouth contains something besides the tongue and are intelligently examining the teeth and the tonsils. Until recently medical students and internes were not taught to notice the condition of the gums and teeth or to associate disease in these organs with the patient's bodily ills. They were allowed to gain the impression that these organs served a mechanical purpose only, and that their pathology was of importance only in proportion to the disturbance of local function which it caused. Lately many observers have commented on the remarkable clinical results in arthritis, neuritis, myositis, and other obscure symptom-complexes following proper dental procedures.

Because it is relatively easy to diagnose a case of pyorrhea and to get the cooperation of the patient in carrying out proper methods of treatment, the relation of this disease to many systemic conditions has been established clinically.

There is another type of tooth disease, however, which, while not so spectacular in its local end results, is probably as dangerous to the health of the patient, namely, the periapical infection. Unless accompanied by a fistula, this painless condition was, until recently, undiagnosed or disregarded, as it was a common practice to regard a painless tooth as a healthy one. The routine use of the x-ray has made the diagnosis relatively easy and has instituted a study of this type of infection by many workers. It has been claimed to be possible to completely sterilize these areas through the root canals, to completely fill the latter, and to eradicate the disease; and roentgenograms have been produced which apparently show a growth of new bone around the tooth apex.

While such results may be possible in the hands of an expert like Callahan, of Cincinnati, it is useless to expect the rank and file of dentistry to do this work, as it requires great patience, accuracy, absolute asepsis, and bacteriologic control of each stage of the operation.

That root canal filling in average hands does not eradicate the disease is shown by the following study of six cases of polyarthritis.

Sixty-two cultures were made from "locked areas" beyond the apices of eighteen teeth that had been root filled from six months to twenty years previously by sixteen different dentists, some of whom are supposed to be authorities in their profession. The following two methods for obtaining cultures were used: If the culture was made for research purposes only, the gum and alveolar process were isolated with cotton rolls like those used routinely in dentistry, dried, and painted with full strength tincture of iodine. A dental hypodermic syringe, which had been previously boiled and allowed to cool, was fitted with a needle, sterilized in the same way and finally passed through a Bunsen flame. A puncture was then made through the gum and alveolar process down to the root

tip, and an attempt was made to aspirate. The aspirated material, whether visible or not, was transferred to suitable culture media and taken to the laboratory for study. Care was taken to culture only those teeth which had no pyorrhea pockets surrounding them. If the tooth was to be extracted, an area for two inches around was isolated with cotton rolls and painted with iodine. The region was then infiltrated with novocaine solution which had been boiled and proved to be sterile by bacteriologic checks. The electrocautery was next used around the neck of the tooth and it was extracted through this sterile field with a forceps which had been heated in the flame. The apex was then clipped off into the culture medium by means of a heavy rongeur forceps which had also been flamed.

Growth was obtained without exception from each of the sixty-two cultures on some one of the media used. The organisms usually isolated were those found normally in the mouth. The streptococcus viridans was the predominating one; it occurred in sixty cultures. The staphylococcus family was represented in sixteen, always in combination with the streptococcus, while the colon bacillus was isolated in pure culture once. One culture yielded bacillus acidophilis.

It was not possible to obtain cultures from normal teeth by extraction so that control of the second cultural method described above could not be obtained. The area beyond the apex of one normal tooth was aspirated and cultured for control purposes. This did not yield a growth.

If present day dental technic in average hands does not eradicate this type of mouth infection, it is evident that dead teeth in a patient's mouth are a source of danger. Unless an expert root canal operator is at hand, it is good practice to have such teeth removed. To obtain the best results there must be complete cooperation between the physician and the general dental practitioner that they may decide which teeth should be preserved and which teeth must be removed.

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EDITORIALS

Appliances for Physiologic Tooth Movement

DURING the last two or three years several types of orthodontic appliances have been placed upon the market and widely advertised. One of the principal features recommending the appliance has been its ability to produce physiologic tooth movement. The term "physiologic tooth movement" has been used by the manufacturers as a smooth-sounding advertising phrase which has led the public to use certain styles of appliances without stopping to consider what physiologic tooth movement really is. In fact, we find very little in orthodontic literature that explains what physiologic tooth movement consists of. In a description of a number of regulating appliances we also fail to find a positive statement as to why this or that particular appliance is capable of producing physiologic tooth movement to a greater extent than some other appliance. In fact, before we can be certain that any appliance produces a physiologic tooth

movement, we must have some idea as to what constitutes such a movement.

Without being particular in regard to what physiologic tooth movement means, we might say that it consists in the movement of the tooth according to natural or physiologic lines. In the development of the dental arch the physiologic tooth movement is the movement of the teeth during the process of eruption. It might also be said that the tipping or moving of teeth as the result of extraction destroying the proximal contact is to a certain extent a physiologic tooth movement produced by a change of conditions. However, we believe we can safely say that the eruption of a tooth is the result of physiologic development and constitutes in reality a physiologic tooth movement. In that case we have a normal action of all the tissues surrounding the tooth, which is physiologic.

One of the things that we notice during the eruption of the average tooth is that it takes its position in the dental arch without any pain or inconvenience to the individual. In fact, the eruption of teeth that is accomplished by pain is not a physiologic tooth eruption, but one associated with pathologic conditions. Therefore, the first requirement of a physiologic tooth movement is the absence of pain. When we place this as one of the requirements of physiologic tooth movement, we find that a large number of regulating appliances fail in this respect immediately. In fact, the majority of orthodontic practitioners expect to have the patient experience a certain amount of pain during the early treatment of the case and some of them have more or less pain during the entire operation. A great many men are willing to admit to their patients that tooth movement or regulation is accomplished by more or less inconvenience and pain during the entire operation and especially at the first adjustment of the appliance. Now, if a regulating appliance is to produce physiologic tooth movement, it must produce that movement without pain. There are very few appliances on the market that fulfill those requirements, and some of the most advertised physiologic tooth "movers" produce more pain than any other style of appliance. We are willing to admit that sometimes it is difficult to adjust a regulating appliance the first time without making the teeth sore, but if the teeth are sore, it is the fault of the technic, and not the fault of the appliance. In other words, with the properly constructed appliance and with the proper technic, there should be no pain at any time during the correction of a case of malocclusion, and certainly there must be no pain with the appliance moving the teeth physiologically.

In considering the question of physiologic tooth movement, we must also consider the manner in which teeth move during the process of eruption and the condition under which the dental apparatus works. If we study the eruption or the development of the dental apparatus, we find that all the teeth do not make their appearance at the same time, and all of the teeth do not travel in the same direction during the time they are taking their place in the dental arch. They are free to assume positions under the forces of occlusion and take those positions by some of them traveling in one direction and some in another. Nearly every erupting tooth during its process of eruption travels in two directions or more. Of course, it always travels occlusally, but it may also travel buccally or lingually, or mesially or distally during the time it takes its position

in the dental arch. In other words, an erupting tooth does not travel in a positive and direct line, the crown and apex do not move an equal distance or along lines parallel with each other. An erupting tooth does not travel bodily with the crown and the root moving in parallel lines. Very often the crown travels on more or less in the arc of a circle as compared with the apex of the root. If a tooth is naturally inclined to travel in the arc of a circle during the process of eruption, does it not necessarily follow that in producing physiologic tooth movement the tooth must be left free to respond to the forces of occlusion which sometimes will make the crown and the root travel in more or less of an arc of a circle? It therefore follows, that regulating appliances which are supposed to produce physiologic tooth movement will be more satisfactory as they allow the tooth to assume its position under the natural forces of occlusion. Very few teeth require movement in a bodily manner, which means that the crown and the apex travel in parallel lines to each other.

It must also be remembered that in certain types of malocclusion where the teeth have assumed extreme positions it will be necessary by mechanical stimulation to produce a tooth movement which, so far as direction is concerned, does not approach anything we find during the normal process of eruption and development of the denture. However, when it is necessary to produce those extreme tooth movements, the mechanical force applied to the tooth must be of such a nature and of such a character as to produce those extreme movements according to physiologic principles as mentioned before; namely, without the production of pain. If there is any pain during the movement of the tooth, it is an indication that the tooth is not moving physiologically. In order to have a physiologic tooth movement, we do not believe it is possible to move a tooth with a mechanical appliance very much more rapidly than it would move during the natural process of eruption. In extreme cases of malocclusion it necessarily follows that a considerable length of time will be consumed in producing physiologic tooth movement, and the production of a normal occlusion. However, with some appliances that are on the market, the designers advocate a rapid tooth movement, claiming that their appliance is so constructed that a physiologic tooth movement and a correction of the most extreme types of malocclusion can be accomplished in five months. Those who have had any experience with the correction of a large number of malocclusions and who have been observing enough to consider the detriment of rapid tooth movement can only realize the extreme amount of harm that is going to be done by men of small experience trying to follow the advice of appliance designers and manufacturers who advocate a rapid tooth movement and claim that a rapid tooth movement is physiologic.

As a caution to those who are anxious of obtaining the best results and doing the greatest good to their patients we can only say that if there is a physiologic tooth movement they must have a correction of the malocclusion without pain. If the teeth are sore, it matters not what appliance is being used, a physiologic tooth movement is not being produced, and something should be done to modify the appliance so that the soreness will disappear from the teeth. Just exactly what change occurs in the tissues during tooth movement is interesting

from a histologic and scientific standpoint; but from a practical standpoint, we have a positive indication when things are going on correctly and that indication is the absence of pain. Absence of pain is the strongest indication that we have physiologic tooth movement and should be taken as a guide in the treatment of all cases.

Orthodontics and the National Dental Association

EVERYONE familiar with the growth and reorganization of the National Dental Association and with the progress made by orthodontics as a specialty, will realize that the science of orthodontics has not been given the recognition by the National Dental Association to which it is entitled. A glance over the programs of the association for the last few years will convince one that orthodontics has been given a very small place. No doubt the reason for this is that the officers of the National Dental Association have realized that orthodontics is a specialty and has a society of its own which holds meetings and is attended by men who are interested in orthodontics, and orthodontics alone. As a result of this, orthodontics has been kept in a section with other branches and has been given but little recognition. This arrangement has existed because comparatively few men who have attended the National Dental Association in years past have been interested in orthodontics.

With the reorganization of the National Dental Association came the tendency for different sections to hold separate meetings. We believe that at the present time there are enough men interested in orthodontics who attend the National Dental Association each year to make the organization of an Orthodontic Section advisable. At the meeting in New York City there were several branches of dentistry that had separate sections, and we believe they were entitled to representation in the House of Delegates because of being so organized. These sections had their own officers and their own meetings, and we believe they were more profitable to the men attending them than if they had been kept a part of some other section.

We do not believe that the organization of an Orthodontic Section in the National Dental Association would in any way detract from the attendance of the American Society of Orthodontists, nor do we believe that it would in any way conflict. While a great many men who are members of the American Society of Orthodontists always attend the National Dental Association, there are also many men engaged in the practice of orthodontia who attend the National Dental Association, but do not attend the American Society of Orthodontists. There are various reasons for this, which need not be mentioned here. These reasons are such that the organization of an orthodontic section in the National Dental Association would tend to advance orthodontics as a science and in no way be detrimental to the orthodontic societies already organized. In going over the past program of the National Dental Association, while in some instances we find that men who have read papers before the orthodontic branch of this association have also read papers before the American Society of Ortho-

dontists, we also observe that many men who have read orthodontic papers before the National Dental Association have never read a paper before the American Society of Orthodontists, and do not even possess membership in that society.

The organization of a special section entitles that section to representation in the House of Delegates, and the orthodontic profession would, no doubt, have a better standing were it represented by a delegate the same as the Crown and Bridge Section, the Prophylactic Section, the Prosthetic Section, the Section of Anesthetists, and others.

Unless someone can show us that there are not enough orthodontists in the National Dental Association to be entitled to a section governed by its own officers, we believe that something should be done towards the organization of such a section, and we should be glad to use our influence in advocating and perfecting it.

Gritting the Teeth as a Sign of Adenoids

BENJAMINS states that in his experience with 250 cases of adenoids in India and 526 at Utrecht, as also in the experiences of others, comprising a total of 1,544 adenoid cases, a tendency to grit the teeth was manifest in from 25 to over 40 per cent, an average of 34.1 per cent. In his own experience the average was 37.2 and 34.6 per cent. In his 776 cases there was snoring in over 60 per cent; enuresis in 29 per cent; aprosexia in 34.6 per cent, and disturbances in hearing in 42.7 per cent. In 153 operative cases of adenoids, the gritting of the teeth stopped after the removal of the adenoids, and in fourteen it became much less, but it persisted unmodified in fourteen. Examination of 1,654 school children showed gritting of the teeth in 13.6 per cent. Benjamins is confident that the majority of the teeth gritters will be found to have adenoids. In a series of 115 teeth gritters examined for affections other than adenoids, all but two were found to have adenoids. In 10 of the children the teeth gritting was the only anomaly to attract attention, but a large adenoid was discovered in four.—*C. E. Benjamins, in Nederl. Tijdschr. v. Geneesk.*

Inducing a Child to Open Its Mouth

THE rough, brutal and often unsuccessful methods of inducing a terrified child to open its clenched jaws, for intubation, inspection of fauces, or other purposes, would never be inflicted if the simple, painless and always successful method followed for years in Dr. Chevalier Jackson's clinic were known. A seven-inch bent probe is introduced at a gap between or posterior to the teeth and pushed backward until the distal end of the probe reaches down back of the tongue near the epiglottis. This causes the jaws and mouth at once to open. A bite-block or gag is then inserted.—*The Laryngoscope.*

Our Former Teachers in Germany

MANY medical men in this country have visited Germany for the purpose of continuing their studies. The laboratories and clinics of German universities were quite familiar to American medical men. We know the Anglo-American Societies at Berlin and Vienna and have spent many pleasant evenings at them. There we met many of our colleagues from this side and were introduced to leading German professors who talked to us and considerately offered to form classes in the various medical specialties if so many would attend at so many marks each. We learned much at some of these special clinics and lectures, and our professors were able to convert many dollars into marks. The relations between teacher and students were pleasant and for the most part profitable to both. We learned to admire many of these great teachers and possibly to love a few of them. When the war began our old teachers assumed that their old students would be pro-German. Indeed, they could conceive of nothing else. Probably no one in this country, not of German birth or descent understood the German mind and its attitude toward science and truth better than those of us who had studied in German universities. To us the German professor revealed himself better and more fully than anyone else could have done. Every lecture and demonstration was an exhibition of his psychology and in this there were many things which no truth-respecting individual could admire. He was generally a learned man in a narrow way, but too often his learning was greatly overshadowed by his arrogance. To him science was "Die deutsche Wissenschaft" and he found frequent opportunity to extol it. He seldom referred to the researches of the men of other nations, and, when he did so, he most authoritatively criticized, minimized, or misstated the facts.

In a course of lectures on the development of abdominal surgery I heard one of the most eminent of German professors say that Bilroth was the first to do an ovariotomy. As I listened I thought of the shades of Ephraim McDowell and his immediate American and English successors, and I wondered whether ignorance or arrogance was the basis of the false statement, and I pitied my German coauditors who evidently accepted it as truth. In this instance I did dare to remonstrate with the learned man at the close of his lecture, but the interview still left me undecided between his ignorance and arrogance. A course of lectures in the history of our knowledge of digestion contained no reference to the work of our Beaumont and Dunglison, although it is true that at the very time that Beaumont was making his classical studies on Alexis St. Martin, the professor of physiology in the University of Berlin was teaching that the stomach is simply a storage and not a digestive organ. I have searched the voluminous German literature on toxins and antitoxins without finding mention of the fundamental researches of Mitchell and Reichert at the University of Pennsylvania or that of Sewall at the University of Michigan. On the other hand, Calmette and other French immunologists, on visiting Ann Arbor, have first of all wished to see the place where Sewall first immunized pigeons to snake venom. The German professor begins the history of tuberculosis with the discovery of the bacillus by Koch, and one would in no way detract from the honor due to the untiring zeal

of this great man; but it is a fact that at least a decade before Koch began his work on tuberculosis, Villemin had demonstrated the presence of a virus in the tissue and certain excretions of tuberculous animals, including man. Indeed, he went much further than this and demonstrated the unity of tuberculous infections, a fact up to that time most vigorously denied by Virchow and other German teachers.

We know how the German mind has misunderstood and misinterpreted the teachings of Darwin. In the "survival of the fittest," he has decided that he is the only one "fit." "In the struggle for existence," he has shown himself capable of using the most brutal weapons and to resort to the prostitution of science to the accomplishment of his personal and national desires. His arrogance, so plainly in evidence in his classrooms years ago, has grown into a megalomania which has engulfed the world in a cataclysm and threatens to overthrow the pillars of civilization. The German mind is still in an infantile state, and science in German hands is as dangerous as explosives in a playroom.

American scientists who have studied at German universities are not as a rule pro-German. Individually we respected many of our teachers, but we were not blind to their defects. Because we did not leave the table in rudeness, they assumed that we enjoyed the food they supplied, and we did. There was some real sustenance in the broth and a few plums in the pudding, enough to make it worth while, since we already had the fundamentals of science and were able for the most part at least to distinguish between the real and the false. In short, our German professors at that time gave us both instruction and amusement. We were not idiots, blind, or deaf, but we did not fully appreciate the pathologic significance of that well-nigh universal German attribute of arrogance and self-conceit. Even at that time it occasionally became boresome and even disgusting, but we did not fully realize its malignant capabilities. It has grown into a great tumor and must be excised if it takes the rest of the world and all time to do it.

Even the tyro in science knows that most of its great discoveries are not of German origin. What of the steam engine, the compass, the telegraph, the telephone, the aeroplane, even the submarine—the list might be indefinitely extended. Science is the exclusive property of no nation; its functions are normally beneficent; its devotees seek the welfare of the race, and not personal or national aggrandizement. Did we have patents on the medicinal uses of quinine, the iodides, the employment of anesthetics and antiseptics? No, we left the patent medicine business to charlatans in this country and German scientists abroad, and both fattened on our good nature and our dollars. (Editorial by Dr. V. C. Vaughan, *Journal of Laboratory and Clinical Medicine*, Dec., 1917.)

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ORIGINAL ARTICLES

OBSERVATIONS ON THE FORM OF THE DENTAL ARCH OF THE ORANG*

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THE prevailing notion regarding the conformation of the dental arch of the anthropoid ape appears to be so thoroughly settled in the minds of many scientists that it would seem an imposition for any one to attempt a reiteration of facts so widely known and generally accepted. Superposing this thought with the idea that what is contained in the present contribution is somewhat at variance with what has hitherto been advanced, it becomes a rather delicate task for one who considers himself not fully qualified to speak authoritatively on the subject of anthropology. It is, therefore, my intention to submit these observations with a feeling of reserve, confining myself to a description of the actual facts observed and claiming no epoch-making discoveries in the endeavor to contribute something that may aid in the correction of some of the numerous errors that befog our views in the perception of the truth.

Especially, is it necessary now to rouse no undue expectations by advancing any theories or making final deductions, as this is but the beginning of an investigation which will extend through the entire anthropoid family, when, with more extensive data on hand and more matured judgment, it will be reasonable to expect some definite conclusions.

The present task involves a description of the phenomena observed in connection with the form of the dental arch of the orang, omitting all attempts of any interpretations, but aiming mainly to answer the following questions:

1. Does the dental arch of the orang conform to the outline as described by various authorities?

2. Is the "diastema" in the orang dentition a phenomenon similar to that appearing in some lower forms?

*Read at the meeting of the New York Academy of Sciences held in May, 1917, at the American Museum of Natural History, New York, N. Y.

3. Is the labidonty or edge-to-edge bite an exclusively pithecoid characteristic?

1. DOES THE DENTAL ARCH OF THE ORANG CONFORM TO THE OUTLINE DESCRIBED BY VARIOUS AUTHORITIES?

Tomes, De Terra, Selenka, and various other authorities concur with the idea that the dental arch form of "the most anthropomorphous apes" differs from that of man, in that "the teeth instead of being arranged in a sweeping curve, the jaws are squarish, the incisors being arranged in something approaching a straight line between the outstanding canines, behind which the premolar and molar series run in straight lines, converging somewhat as they go backward." (Tomes.)

On the examination of the collection numbering eighty-three orang skulls at the National Museum, Washington, D. C., comprising those gathered by W. L. Abbott, the outlines assumed by the dental arches in this ape were found to conform to five different configurations, these forms being determined mainly by the mode of arrangement of the premolar-molar series. The incisors and canines in all these forms coincide with Gregory's description, as forming "an evenly rounded or arched series." The outlines to which the dental arches were found to conform may conveniently be described as follows (see Table I):

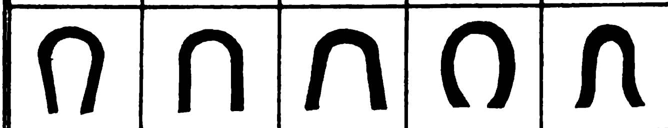
Pyriform	U-shaped	Divergent	O-shaped	Saddle-Shaped
				
36	54	24	17	27

Table I.—Table showing the various forms which the dental arches in the orang assume and frequency of their occurrence. For the sake of simplicity the figures representing these forms will hereafter be referred to by letters. Thus, pyriform, P; U-shaped, U; divergent, D; O-shaped, O; and saddle-shaped, S.

1. The pyriform arch, in which the widest dimensions are in the first premolar region, thereafter the buccal teeth, arranged in straight or nearly straight lines, converge posteriorly. (Fig. 1-*A* and *B*.)

2. The U-shaped arch, in which the premolar-molar series are arranged in straight lines parallel to each other. (Fig. 2-*A*.)

3. The diverging arch, in which the premolar-molar series are arranged in straight or nearly straight lines diverging as they proceed backward. (Figs. 3-*A* and *B*, 4-*B*.)

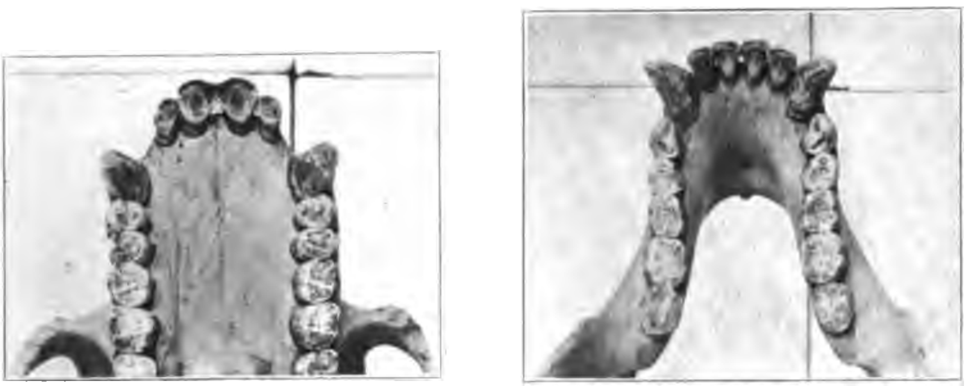
4. The O-shaped or oval arch, in which the premolar-molar series are arranged in curved lines with the convexity toward the cheek. (Fig. 4-*A*) and

5. The saddle-shaped arch, in which the premolar-molar series are arranged in curves with the convexity toward the tongue. (Fig. 5-*A* and *B*, and Fig. 2-*B*.)

The general outline of these forms though perceptible to the eye, on visual observation, were, nevertheless, determined by accurate measurements taken as follows: The width between the two sides of the mouth was obtained by measuring the distance between the premolar-molar series of either side using the cusps of the teeth in the lower jaw and the fossæ of the teeth in the upper, as starting points; thus in the lower jaw the distances between the two sides of the premolar-molar series were measured at the cusp points of the buccal cusps of the pre-

A. *B.*

Fig. 1.—Occlusal view of upper (*A*) and lower (*B*) jaws of male orang showing pyriform type of dental arches. X ⅓.



A. *B.*

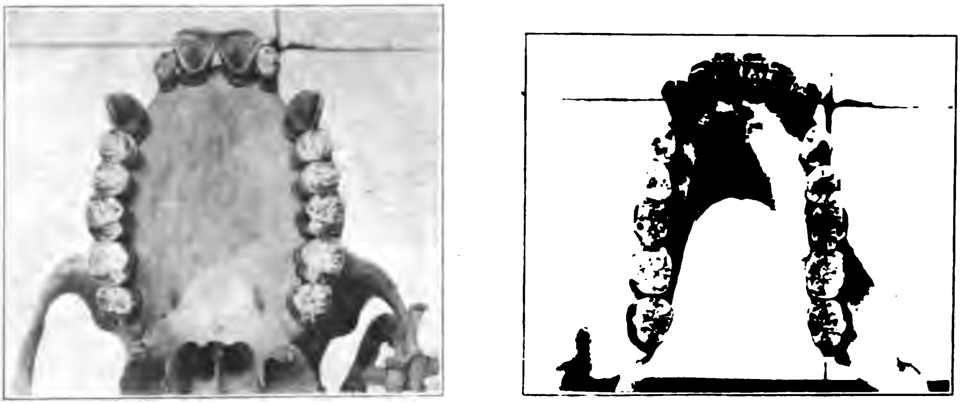
Fig. 2.—Occlusal view of upper (*A*) and lower (*B*) jaws of male orang showing U-shaped upper and saddle-shaped lower dental arches of the same animal.

molars, and the cusp points of the disto-buccal cusps of the molars. In the upper the measurements were taken between the depressions in the occlusal surfaces of the premolars and molars accomodating the cusp points mentioned of the lower teeth.

These forms though exhibited by both the upper as well as the lower dental

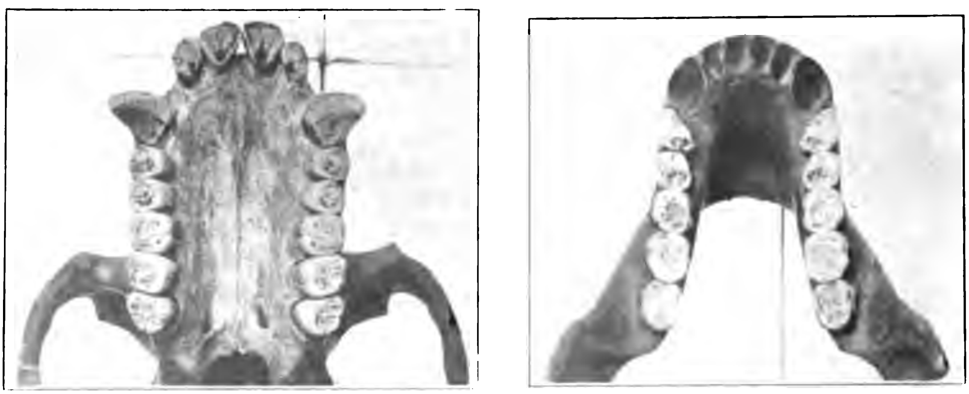
A. *B.*

Fig. 3.—Occlusal view of upper (*A*) and lower (*B*) jaws of female orang showing the divergent form in both dental arches.



A. *B.*

Fig. 4.—Occlusal view of upper (*A*) and lower (*B*) jaws of female orang showing O-shaped form in the upper and the divergent in the lower dental arch of the same animal.



A. *B.*

Fig. 5.—Occlusal view of upper (*A*) and lower (*B*) jaws of male orang showing the saddle-shape in both the upper and lower dental arches, the upper being somewhat less accentuated than the lower.

arches are not necessarily found to be alike in both jaws of the same individual. They may appear in harmonious relationship, as in Figs. 1, 3, and 5, but more often the two dental arches of one individual are independent in form, as in Figs. 2 and 4. Table II shows the frequency with which these forms appear in the upper and lower jaws.

TABLE II

FREQUENCY WITH WHICH THE VARIOUS ARCH FORMS APPEAR IN THE UPPER AND LOWER JAWS*

Form of Dental Arch	P	U	D	O	S
Upper	32	24	9	17	1
Lower	4	30	15	0	26

*The letters in the top row indicate the form of arch, thus: P, pyriform; U, U-shaped; D, divergent; O, O-shaped; and S, saddle-shaped.

Thus, it may be deduced from Table II that while the pyriform arch appears in the upper jaw in the proportion of 8:1 as compared with its frequency in the lower, the O-shaped arch is exclusively prevalent in the upper. The U-shaped arch, on the other hand, is about equally divided between the two jaws, while the saddle-shaped arch is almost entirely confined to the lower, the divergent type being in the proportion of 5:3 in favor of the lower.

TABLE III

DISTRIBUTION AND FREQUENCY OF THE VARIOUS ARCH FORMS AS THEY APPEAR IN THE TWO SEXES*

Form	P		U		D		O		S	
Sex	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Upper	24	8	14	9	1	8	2	15	1	0
Lower	4	0	15	15	5	9	0	0	17	10

*The letters in the top row indicate the forms as follows: P, pyriform; U, U-shaped; D, divergent; O, O-shaped; and S, saddle-shaped.

Though these forms are not exclusively characteristic of sex distinction, yet as may be observed in Table III, there is a slight preponderance of certain arch forms in each sex. Thus in the upper jaw the pyriform and U-shaped arch form seems to be predominant in the male, while the divergent and O-shaped form is found more frequently in the female. In the lower jaw, on the other hand, the pyriform is possessed by the male exclusively, while the divergent is in excess in the female, the U- and O-shaped being equally divided in both sexes and the saddle-shaped favored by the male.

If the dental arches as they appear in their relationship to one another be now examined, the variety of their possible combination will be found quite large. The combination most frequently observed as may be seen in Table IV is the pyriform upper with the saddle-shaped lower, appearing fifteen times. The combinations following this in frequency are the U-Shaped upper with the U-shaped lower, the pyriform upper with the U-shaped lower and the O-shaped upper appearing in equal numbers with the U-shaped and diverging lower. The remaining combinations are rather small and widely distributed.

On taking the sex factor into consideration (see Table V) the male element will be found to be more closely associated with the combinations of the pyriform

TABLE IV

SHOWING IN WHAT COMBINATION AND FREQUENCY THE ARCH FORMS APPEAR IN ONE INDIVIDUAL*

Combination of arch forms	Upper	P	P	P	P	P
	Lower	P	U	D	O	S
Frequency of each combination		3	10	3	0	15
Combination of arch forms	Upper	U	U	U	U	U
	Lower	P	U	D	O	S
Frequency of each combination		0	11	4	0	5
Combination of arch forms	Upper	D	D	D	D	D
	Lower	P	U	D	O	S
Frequency of each combination		0	3	2	0	4
Combination of arch forms	Upper	O	O	O	O	O
	Lower	P	U	D	O	S
Frequency of each combination		1	6	6	0	2
Combination of arch forms	Upper	S	S	S	S	S
	Lower	P	U	D	O	S
Frequency of each combination		0	0	0	0	1

*Letters in two upper rows indicate forms of arch. P, pyriform; U, U-shaped; D, divergent; O, O-shaped; S, saddle-shaped. Each square containing the letters represents a combination as it appears in one individual; the letter above indicating the form of the upper arch, and the letter below that of the lower arch.

TABLE V

SHOWING IN WHAT COMBINATION AND FREQUENCY THE DENTAL ARCH FORMS APPEAR IN ONE INDIVIDUAL OF EACH SEX*

Combination of arch forms	Upper	P		P		P		P		P	
	Lower	P		U		D		O		S	
Sex		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Frequency of combination		3	0	7	3	1	1	0	0	11	4
Combination of arch forms	Upper	U		U		U		U		U	
	Lower	P		U		D		O		S	
Sex		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Frequency of combination		0	0	5	6	2	2	0	0	4	1
Combination of arch forms	Upper	D		D		D		D		D	
	Lower	P		U		D		O		S	
Sex		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Frequency of combination		0	0	1	2	1	1	0	0	0	4
Combination of arch forms	Upper	O		O		O		O		O	
	Lower	P		U		D		O		S	
Sex		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Frequency of combination		0	0	1	5	1	6	0	0	0	2
Combination of arch forms	Upper	S		S		S		S		S	
	Lower	P		U		D		O		S	
Sex		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Frequency of combination		0	0	0	0	0	0	0	0	1	0

*The letters in the top square indicate the forms of arch. P, pyriform; U, U-shaped; D, divergent; O, O-shaped; S, saddle-shaped. Each square containing two letters represents one combination as it appears in one individual; the letter above indicates the form of the upper arch and the letter below, that of the lower arch.

upper with the pyriform, U-shaped and saddle-shaped lower, and the U-shaped upper with the saddle-shaped lower. The female, again, gains an advantage over the male in the combinations of the O-shaped upper with the U-shaped diverging and saddle-shaped lower, the diverging upper with the saddle-shaped lower. The other combinations are more equally distributed between the sexes.

2. IS THE "DIASTEMA" IN THE ORANG DENTITION A PHENOMENON SIMILAR TO THAT FOUND IN LOWER FORMS?

"There is a 'diastema' or interval in front of the upper canine into which the point of the lower canine passes when the mouth is closed." (Tomes.)

The term "diastema," of course, is understood to convey the idea of an inter-

Fig. 6.—Front view of male orang, showing the mechanical juxtaposition of the canine teeth within the spaces or "diastemas" allotted for them.

val or interruption in the continuity of the dental series. If the dentition of the horse be considered, the diastema would be in manifestation, whether the jaws be in apposition or apart. If we, however, consider the orang masticatory apparatus as a whole, with the teeth in occlusion, as in Fig. 6, we could hardly place the diastema of the orang dentition in the same category as that of the horse; for, the space in each jaw is completely occupied by the mechanical juxtaposition of the canines when the jaws are closed. The diastema in the orang dentition may, therefore, be said to be an anatomic provision for the accommodation of the crowns of the opposing canine teeth *in toto* or in part. It is, consequently, not a space between the teeth in the sense that it occurs in the horse dentition, but rather an anatomic adaptation due to mechanical accommodation.

Moreover, the "diastema" besides presenting a break in the continuity of the crowns in the tooth series of each jaw separately, it also indicates the ex-

istence of a bony structure produced as an accompanying factor, of the interval existing between the teeth; namely, the enormously thick septum intervening between the root of the canine and that of the second incisor in the upper jaw and the roots of the first premolar and canine in the lower jaw. The range of variation in the thickness of this septum is from about 1 mm. to 13 mm. in the upper, and from 0.2 to 6 mm. in the lower. So far as was possible to determine, no correlation between this bony septum and the size of the canines, or the size and form of the dental arch was found to exist. It may, however, have some connection with the form, position, and functional activity of the opposing canine teeth. This probability will have to be verified by further studies and observation of the dentitions of this as well as the other genera in the anthropoid family.

The fact of the alveolar process being but a transient structure, coming and going with the teeth, the differences in size of this septum on the two sides

Fig. 7.

Fig. 8.

Fig. 7.—Occlusal view of upper jaw of orang (153818), showing considerable decrease in thickness of the septum anterior to the right canine sockets due to loss of lower right canine.

Fig. 8.—Occlusal view of lower jaw of same specimen as Fig. 7, showing diminution of space where the teeth were lost as compared with the normal side, also forward shifting of lower molars on injured side.

of the same dental arch where the wear of the canines is unequal, would verify the idea that this bony septum, like the rest of the osseous tissues, is subject to mechanical conditions; its bulk being increased or diminished by the mechanical influence of the opposing canines during functional activity. In proportion as this influence decreases or disappears, the thickness of the septum will diminish. An illustrative instance was observed in the specimen No. 153818 (Fig. 7). The upper left septum measures 6.3 mm., while the thickness of the right is only 3 mm. The reason for this difference was found to be due to the absence of the lower right canine, which must have been lost through some accident together with both lower premolars on that side (Fig. 8). The alveolar process of the lower jaw in that region is entirely absorbed and the distance from

the second incisor to the first molar measures 26 mm., while the homologous distance on the opposite side with the canine and premolars *in situ* measures 35 mm. It may be seen, then, that there is a decrease of 9 mm. between the second incisor and first molar of the injured side as compared with the normal one, and also that owing to the loss of these teeth, the loss of their mechanical influence upon the upper teeth brought about a decrease in the thickness of the bony septum in front of the upper right canine to the extent of 3.3 mm.

In man these conditions are variously brought to our notice by certain dis-

Fig. 9.

Fig. 10.

Fig. 9.—Occlusal view of cast of human lower dentition, showing lack of second premolars. The space for the right tooth is entirely obliterated while the left is partly visible.

Fig. 10.—Occlusal view of case of lower dentition of the same individual as Fig. 9, after the spaces for the missing teeth have been restored. The left premolar erupted and assumed its position, while the right tooth germ being absent, bone developed in the interstice to fill in the distance between the roots of the first molar and first premolar.

Fig. 11.—Side view of cast of human dentition showing lack of space between the second lower premolar and second lower molar; the first molar having been lost at an early age. The lower first molar on the right side measures 10 mm., while the space on the left side measures less than 1 mm.

turbances in development and by processes of disease. Thus, Fig. 9 represents a cast of a lower dental arch and alveolar process of an individual in which the second premolars failed to erupt. As a consequence the alveolar process destined to hold that tooth in position, failed to develop. Upon the application of mechanical stress, by means of orthodontic appliances, a space was artificially made to the extent necessary for the accommodation of the missing tooth on either side. The tooth on the left side erupted and the alveolar process developed around it. On the right side of the same jaw, although the same process for

the restoration of space was resorted to, no tooth erupted, there having been no dental germ present; but bone, nevertheless, developed to fill the gap between the roots of the separated teeth. (See Fig. 10.) The reverse phenomenon may be seen in another case (Fig. 11), where the alveolar process had developed, but owing to the loss of the first permanent molar, it disappeared again, allowing the second molar to take its position adjoining the second premolar.

If the skull of a young orang (Fig. 12) be examined before the teeth have erupted, there will be no marked differences noticed in the thickness of the septa separating the various tooth crypts. But when the deciduous dentition is fully developed, as in Fig. 13, these differences become manifest. This fact demonstrates again that the bony septa increase in thickness after the functional activity of the canines is becoming effective.

It is, therefore, quite plain that although in the orang dentition a diastema does exist, it is a manifestation of mechanical conditions brought about by the

Fig. 12.

Fig. 13.

Fig. 12.—Occlusal view of upper jaw of young orang with the teeth in their crypts but quite ready for eruption. Notice lack of marked difference in thickness of the various septa. (After Selenka.)

Fig. 13.—Occlusal view of upper jaw of young orang with deciduous dentition fully developed, showing the appearance of a small "diastema." (After Selenka.)

canines during their development and functional activity, and must be regarded in a sense different than the diastema of other forms, as those, for instance, of the ungulates.

IS LABIDONTY OR EDGE-TO-EDGE BITE A PITHECOID CHARACTERISTIC?

"Also the 'articulation' in the ape appears in a form which Welcker called labidonty." (De Terra.)

Of the fifty-one specimens with the incisors *in situ,* thirty-six showed an edge-to-edge occlusion, and fifteen had a decided overbite. The edge-to-edge occlusion is well illustrated in Fig. 14. The extent of the overbite occlusion ranged from slight lapping of the upper incisors over the lower, to a considerable projection of the upper anterior teeth, as presented in Fig. 15.

Upon the examination of more than two thousand Indian skulls, both in this

institution (The American Museum of Natural History, New York) and at the U. S. National Museum, Washington, the best Indian dentures presented an edge-to-edge relation of the anterior teeth, as in Figs. 16 and 17 (Delaware Indian). In these Indian dentitions, as well as in those of the ape showing an edge-to-edge bite, there is evidence of excessive wear of the teeth, caused evidently by vigorous use of the jaws and also probably due to the trituration of coarse food substances. The examination of two hundred Mongolian skulls, on the other hand, revealed the prevalence of an excessive overbite in the incisor

Fig. 14.—Side view of orang skull showing edge-to-edge bite of the incisor teeth.

Fig. 15.—Side view of orang skull showing overbite in incisor region.

region. (See Figs. 18 and 19, Mongolian, Urga.) As I am informed by Dr. Moore, of the U. S. National Museum, the Indian skulls exhibit a shallow broad glenoid fossa, which accommodates the oval articular process of the mandible, allowing a free movement of jaw during the act of mastication; while in the Mongolian, as I have observed, the fossa is deep and the articular process is narrow, allowing probably a more limited lateral movement of the jaw.

That these explanations are not applicable to the orang temporomandibular articulation is quite certain, for in the orang "the glenoids are 'rather universally' broad and shallow." (Hrdlicka). The wear of the incisors is, therefore, equally excessive in both the edge-to-edge and the overbite dentitions. The fact, how-

ever, remains that in the Indian dentition the percentage of the edge-to-edge relationship of the incisors is very high. If it is a pithecoid characteristic, as suggested by various authorities, it has been inherited by man to a marked degree.

Fig. 16.

Fig. 17.

Fig. 16.—Front view of Indian skull, showing edge-to-edge occlusion of the anterior teeth.
Fig. 17.—Right side view of Indian skull of Fig. 16, showing to better advantage the edge-to-edge relationship of the front teeth.

Fig. 18.

Fig. 19.

Fig. 18.—Front view of Mongolian skull, showing excessive over-bite in the incisor region.
Fig. 19.—Left side view of Mongolian skull of Fig. 18, illustrating the same point.

So far as this investigation has been conducted, it has revealed the following facts:

1. The orang dental arch is not uniform in outline, as described by various authorities, but may be divided into five typical forms, as pointed out above.

2. Although the diastema is described as an interval occurring between the crowns of certain teeth in the dental arch, it has underlying this manifestation, a bony structure, *the root septum,* the dimensions of which are subject to the mechanical conditions brought about by developmental influences and the functional activities of the canines.

3. Though the edge-to-edge bite of the incisors is prevalent in the orang, it is not an exclusive characteristic, and may be found to exist in the Indian dentition to an equally high degree, while the overbite relationship is also of frequent occurrence in the ape.

In conclusion I wish to express my thanks and gratitude to Prof. Holmes, Dr. Hrdlicka, Dr. Miller, and Dr. Moore, of the U. S. National Museum, Washington, D. C., for their kindness and interest shown me during the course of this investigation, and to Dr. Gregory of this museum for various courtesies shown me.

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PHOTO-SURVEYS OF THE HUMAN DENTURE*

By Rudolph L. Hanau, Pittsburgh, Pa.

Consulting Dental Engineer

ON previous occasions, it has been my privilege to acquaint the dental profession with some of my work in dental engineering, the new science allying itself with practical orthodontics which will give it preciseness in investigation, accuracy in the interpretation of working plans, and methodical, logical, and legitimate lines of thought and work, which *must* lead to definite results, such as modern engineering demands and determines.

It is no longer necessary to point out to medical men the advantage of roentgenograms. They show us things which the naked eye can not discover. The same is true of orthophotographs.

Dr. Lowe J. Young in his paper, read before the First District Dental Society, S., N. Y., says:

"The first aim of a true professional should be to serve his clientele in the best possible manner."

Patients are to enjoy, primarily, the benefit of specialized training, and are given the treatment they need, which is not, necessarily, what they themselves most desire nor what suits our convenience.

If it is the practitioner's purpose to conform to the aim stated above, he can do justice to himself, to his patients, and to his profession, *only* if he keeps pace with the progress of his profession by making intelligent use of all means—educational and physical,—thereby raising his work to the highest possible standard.

It has not yet been generally acknowledged that orthophotography is one of the aids which will enable orthodontists to do more comprehensive, and consequently, better work.

I shall endeavor to prove that orthophotographs, or photo-surveys, as I prefer to call them, are an absolute necessity to orthodontists, as much so as are plaster casts.

The one supplements the other. Especially would I suggest that students,—and those not yet fully versed in the art of reading and using photo-surveys, always make use of both the plaster cast and the photo-survey in their work.

The orthophotographic apparatus consists, substantially, of a photographic camera and a condenser lens, (or lens combination) placed between the camera and the object to be surveyed. The focus of the condenser should be about the center of the camera lens, so that all rays from the negative plate to the condenser are deflected by the condenser to continue in parallel rays on the object side of the condenser. The entire combination is illustrated in Fig. 1.

Figs. 2 and 3 show photo-surveys of an upper and a lower arch. Surveys made by the mechanical surveying apparatus proved impracticable to a certain

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 6, 1917.

degree, because their production consumes a great deal of time, and also because they are read with difficulty by orthodontists in general.*

The photo-surveys (Figs. 2 and 3) picture the denture in a form familiar to all of us; photographs showing every detail,—cusps, fossæ, gum lines, etc. They possess all the advantages of a photograph, and incorporate the refined properties of the old point-method survey. Measurements at different depths of the denture may be made directly on a scale which is photographed with the plaster cast.† The photo-surveys may be made to any desired scale. Enlargements are urged for investigation and research work.

Measurements are made with the aid of dividers.

The use of the microscope has been advocated for making measurements directly on the plaster cast. For various reasons this method must be considered fallacious.

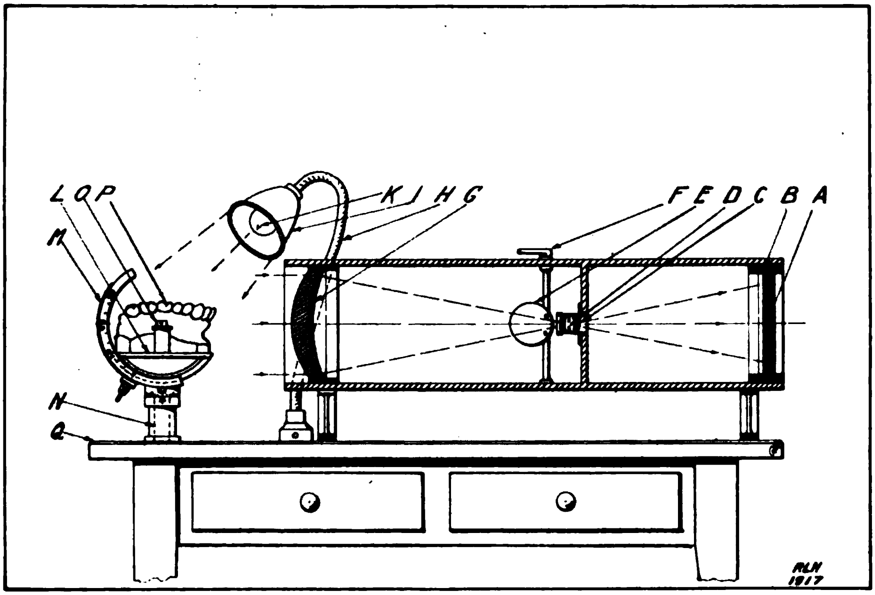


Fig. 1.—Orthophotographic apparatus. *A*, negative plate or film in *B*, an ordinary plate holder; *C*, photographic lens combination; *D*, aperture; *E*, exposure disk; *F*, handle and shaft operating *E*; *G*, condenser lens combination; *H*, adjustable light holder (two required); *I*, reflector; *K*, light (two required); *L*, platform adjustable on *M*, segment, and *N*, pivot; *O*, vise attachment (two required) to hold *P*, the object to be surveyed; *Q*, table or board to which the entire combination may be rigidly attached.

Excellent results are attained when the outlines of teeth, fossæ, cusps, etc., of both the upper and the lower denture are traced, brought into proper correlation, and printed on mat photographic paper.

On such print, the teeth of the upper and the lower jaw, appear in white on a dark background. Lines and points belonging to one jaw are differentiated from those of the other by various-colored pencil or ink lines.

In some of my work I used celluloid films instead of tracing cloth. A photographic contact print or enlargement was made directly upon the films. The lines and points of interest were marked on the film with India ink. Then the

*The reader is referred to a carefully plotted survey illustrated in the JOURNAL, Nov., 1917, iii, 652.
†See the JOURNAL, Nov., 1917, iii, 654.

film was washed in a bath especially prepared for eliminating the photographic print, the India ink remaining upon the film. The result was a perfectly transparent survey, which could effectually be brought into proper relation with the mating jaw, or with surveys of the same jaw, in its various phases of treatment.

For a given set of teeth there exists not only one arch form which complies with our known rules of occlusion, but an indefinite number of them. The factors influencing the arch form, have already been presented to you on previous occasions.

Fig. 2.

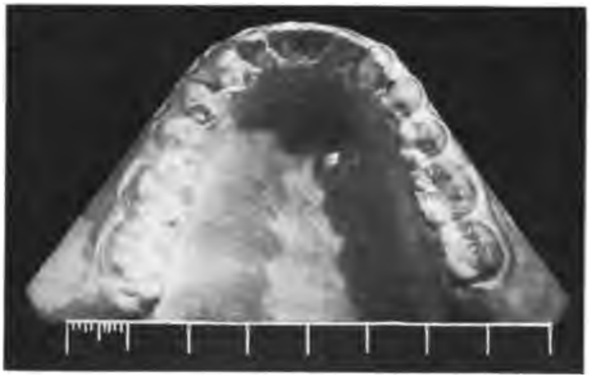
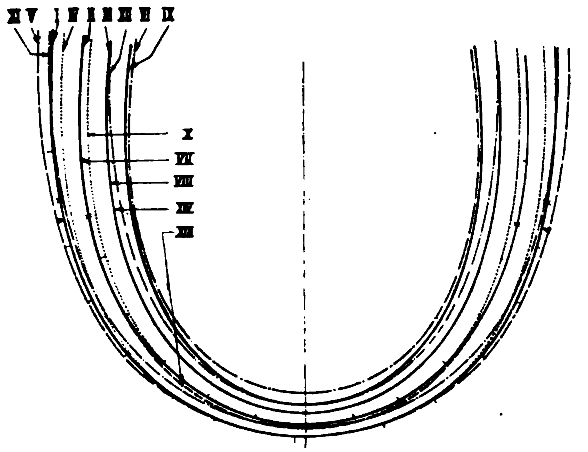


Fig. 3.

If only one form existed, it would be a matter of mere chance for any one man to predetermine it.

That means we should endeavor to reconstruct that arch form which most likely will conform to given conditions. This predetermined arch form is subject to changes because we are limited to a great extent in making accurate measurements. *If we were able to introduce absolutely correct measurements (which we can not do) and had absolute and full knowledge of all requirements that make occlusion and mastication perfect (which is not the case)*, then we would be able to reconstruct an arch form best suited for a given set of teeth



DENTAL CURVES

CURVES	UPPER	LOWER
BUCCAL CUSP	I	VII
FOSSAE	II	VIII
LINGUAL CUSP	III	IX
COMPENSATING CONTACT	IV	X
OUTER GUM	V	XI
INNER GUM	VI	XII
OUTER CURVE OF OCCLUSAL CONTACT	XIII	
INNER CURVE OF OCCLUSAL CONTACT	XIV	

Fig. 4.

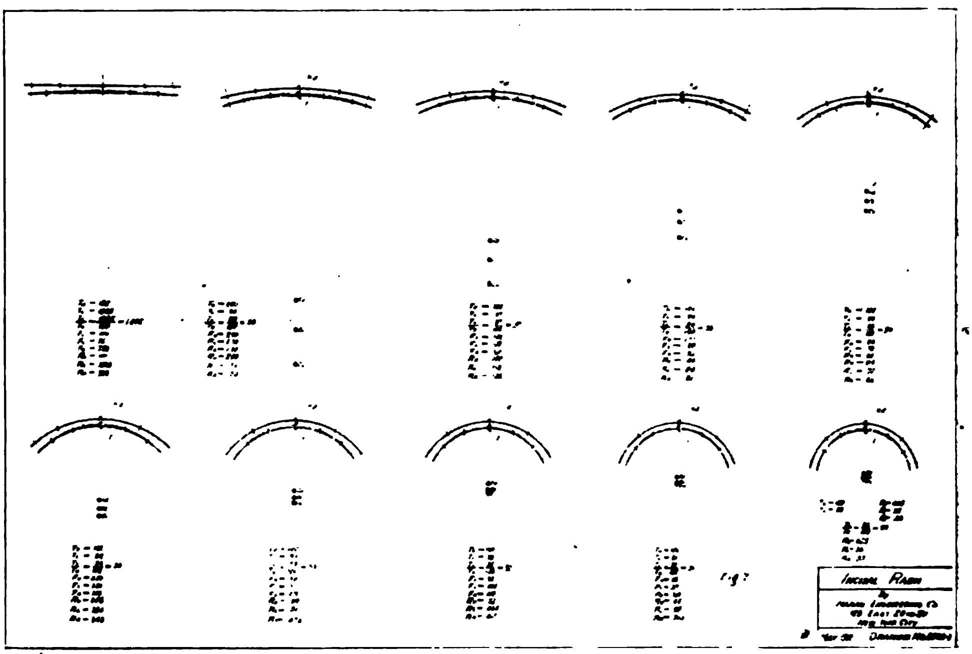


Fig. 5.

in the mouth. Whether such an arch form is the one nature intended, can hardly be claimed.

At your last convention in Pittsburgh, I read a paper that pointed out the

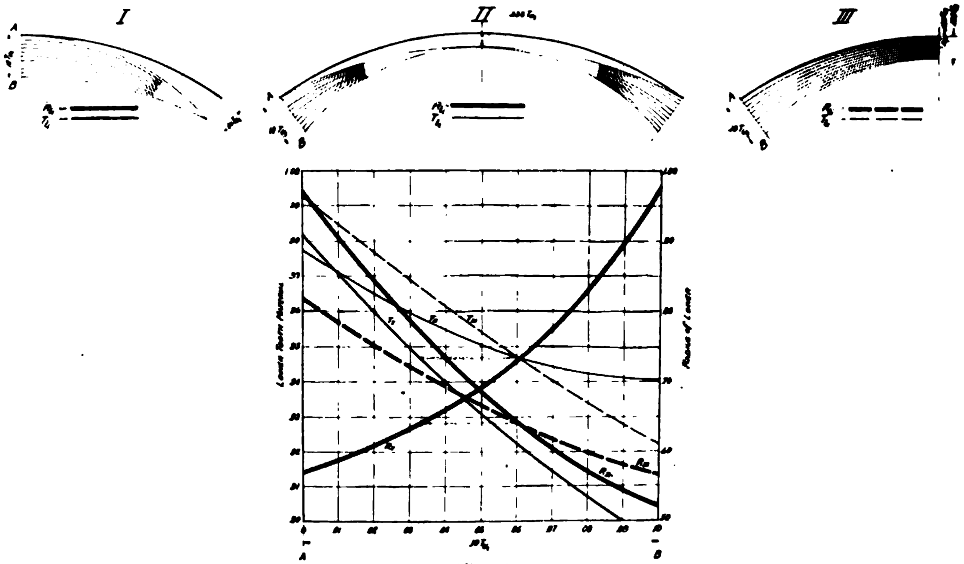


Fig. 6.

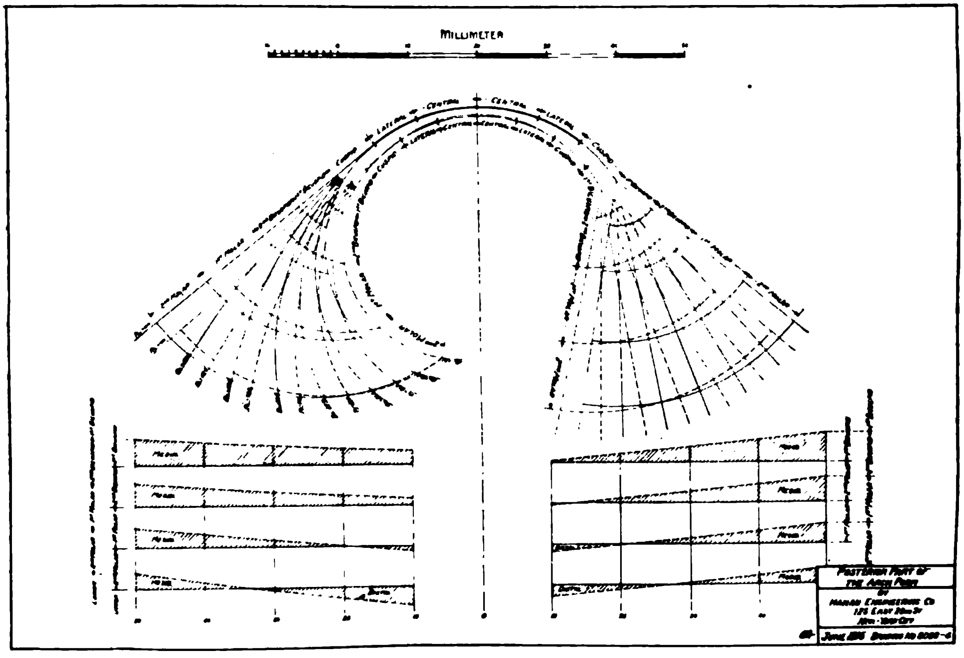


Fig. 7.

fallacy which considers the human arch forms to be similar geometrical figures such as the Bonwill or Hawley arch forms represent. With regret, I learned that it has not yet been possible to put my findings into print so that it may be

accessible to the profession as a whole.* Permit me to refresh your memory by showing a few illustrations which are an integral part of that paper, and are of particular interest in connection with this article.

It was pointed out that there exists a harmonious relation between dental curves (Fig. 4) where occlusion prevails. *This harmony immediately disappears on the survey of a denture in malocclusion.* Fig. 5 recalls the change of the radii of curvature for a change of the incisal ratio of the tooth material but constant labio-lingual distances of the C. C. Curves.

Fig. 6 illustrates the relationship of the lower tooth material and the labio-lingual distances to a given upper tooth material on a given U. C. C. Curve.

Those who have been searching for the solution of the problem of the over-bite will find the answer in this figure.

Fig. 7 is a representation of the mesio-distal relation of points on the C. C.

Fig. 8.

Curves for different radii of curvatures but for the same tooth material. At one time a sudden change in the cuspal region is considered and at another a gradual change of the C. C. Curves in their posterior extensions.

Fig. 8 is introduced to illustrate an ordinary photo-survey; cuspal views of the upper and lower arch, as well as the left side elevations of both are shown. Attention is called to the more rapid rise of the compensating contact curve (C. C. C.); this is due to smaller radii of curvature of the upper C. C. C. in the side elevation.

It is exceedingly difficult, if not impossible with the naked eye *to compare the radius of curvature of a concavity with that of a convexity. On a photo-survey, the magnitude can be measured.* It may be mentioned that the lower buccal cusp curve (L.B.C.C.) and the upper compensating contact curve (U.C.C.C.) in the molar and cuspal region are almost equidistant curves in space.

The upper buccal cusp curve (U.B.C.C.) rises at its posterior end to, and

*See the Journal, Nov., 1917, iii, 635.

even above, the U. C. C. C. This is due to the increasing buccal inclination of the molar crowns posteriorly.

I particularly point to these characteristic forms, which already are familiar to you, because they can be measured and recorded on the photo-survey. The value of records need not be emphasized; they speak for themselves.

Fig. 9 is a photo-survey illustrating the labio-lingual, linguo-labial, and bucco-lingual views of the same denture shown in Fig. 8. It is a beautiful specimen of an end-to-end bite, the plaster cast of which Dr. J. Lowe Young was good enough to let me use for this occasion.

The next case (Figs. 10 to 21, inclusive) traces the work of a case under treatment. The legends under the illustrations are explanatory.

These figures are a reproduction of the actual surveys delivered to the orthodontist. They were mounted on cardboard, ordinarily they are combined in booklet form.

Fig. 9.

This case is interesting on account of the enormous tooth movements which had to be made. A supernumerary incisor (the most distal left lower incisor) was extracted. The consequence was a change in position of every tooth in the mouth.

The arches seem to have been swung bodily. According to Figs. 20 and 21, Plates 7 and 8, the upper left and both lower halves were moved to the left while only the upper right bicuspids show a pronounced movement to the right on the survey.

It is evident that the entire remaining denture was not moved by an appliance anchored on the two bicuspids mentioned. It would be very much like having a horse try to pull the Vaterland up the Hudson river to her pier. Therefore, we must have another explanation.

The forces of malocclusion, acting muscular forces, etc., were balanced during the state of malocclusion (set malocclusion). Through the extraction of the supernumerary, the equilibrium was upset. Tooth movement set in, muscular and other forces performed their normal function in forcing the teeth

towards a new position of equilibrium, possibly into occlusion, and the orthodontist followed his calling by clearing the way of obstructions and gently guiding the teeth. Thus he cooperated with Nature.

The survey, if of any value in this investigation, must be a means of analyzing the case. The following analyses are offered:

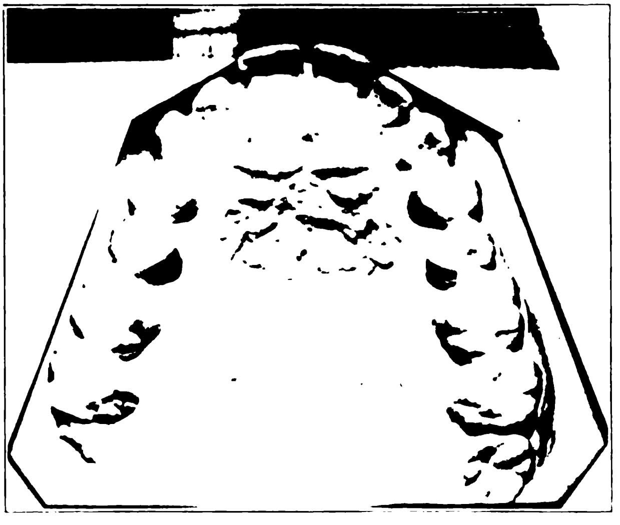


Fig. 10.—Plate 1. Photo-survey of upper jaw (A).

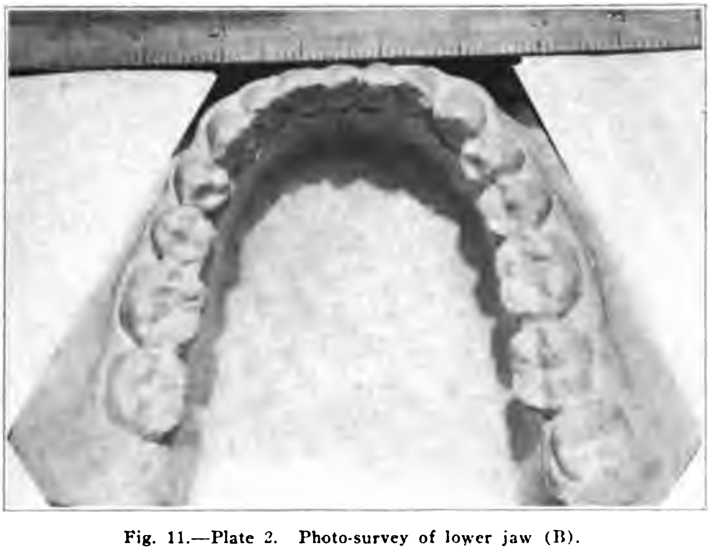


Fig. 11.—Plate 2. Photo-survey of lower jaw (B).

Individual teeth or small groups of teeth were pitched against the remaining denture, successively, a rather tedious job. In our case, however, it is not likely that such a course was followed (Figs. 20 and 21).

The photo-surveys, Plates 7 and 8 indicate that stress was applied to pull together the right and the left lower arches.

Five teeth on the left were probably pitched against nine on the opposite side. The right second molar acted as a quasi-pivot, even though it had not rigidly or pivotally been connected with the arch wire. The wire pressed lingually against the first molar, the bicuspids and the cuspid.

Fig. 12.—Plate 3. Photo-survey of upper jaw (C).

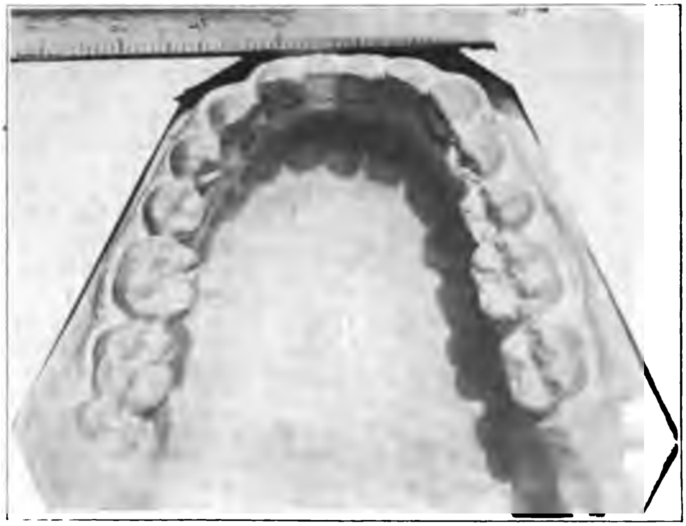


Fig. 13.—Plate 4. Photo-survey of lower jaw (D).

The anterior and posterior resultant forces terminated, say, in the third molar and the cuspid.

So far as transmission of forces within the arch is concerned, the cuspid was resting on the four incisors; the latter progressed in line towards the open space left by the extracted tooth, the remaining left was necessarily pulled to-

wards this very space, and was carried buccally. Strong intermaxillary forces acted in relining the right first molars and bicuspids. The upper centrals, as appears on the survey, were righted by swinging their roots labially. Con-

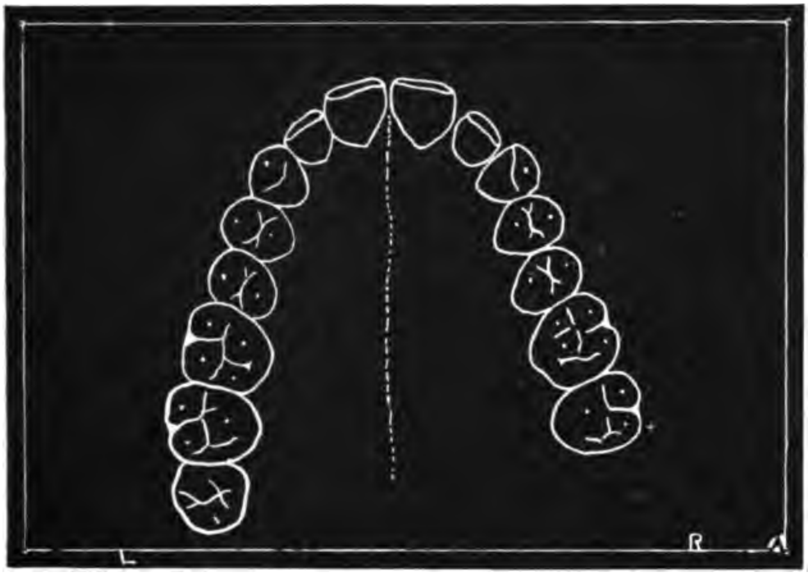


Fig. 14.—Plate 1 (A). Photo-survey of upper arch before treatment.

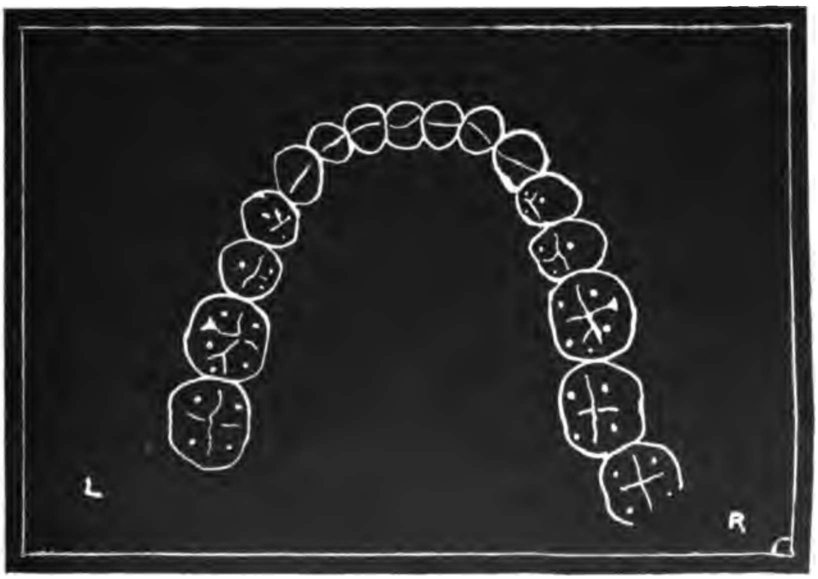


Fig. 15.—Plate 2 (B). Photo-survey of lower arch before treatment.

trary to this hypothesis is the observation that both the upper and the lower left cuspal region were carried labially. I am inclined to believe that the relation of the teeth shown on the survey is somewhat exaggerated; the new position of

the teeth being shown too far to the left. But, if the surveys are correct, strong forces, probably muscular forces, may account for such surprising movements.

It is of great importance to mention that all these tooth movements were reconstructed on the assumption that a molar can not be moved distally.

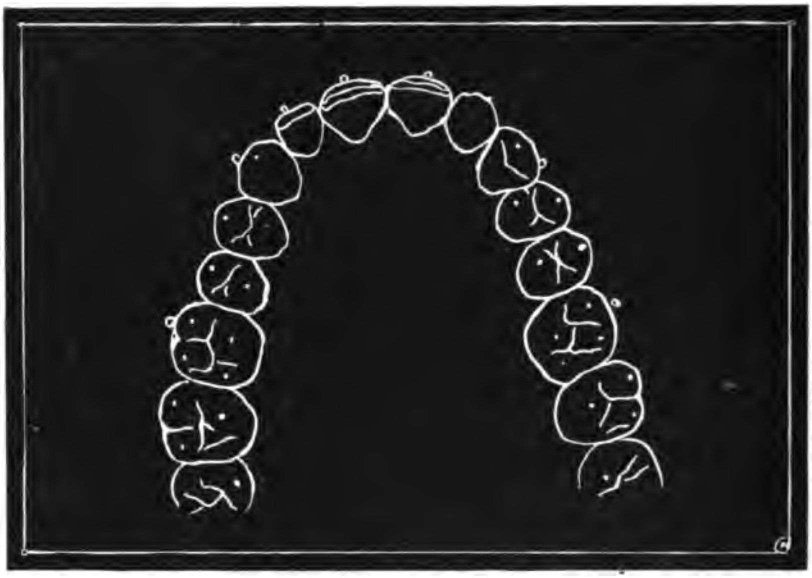


Fig. 16.—Plate 3 (C). Photo-survey of upper arch, supernumerary extracted.

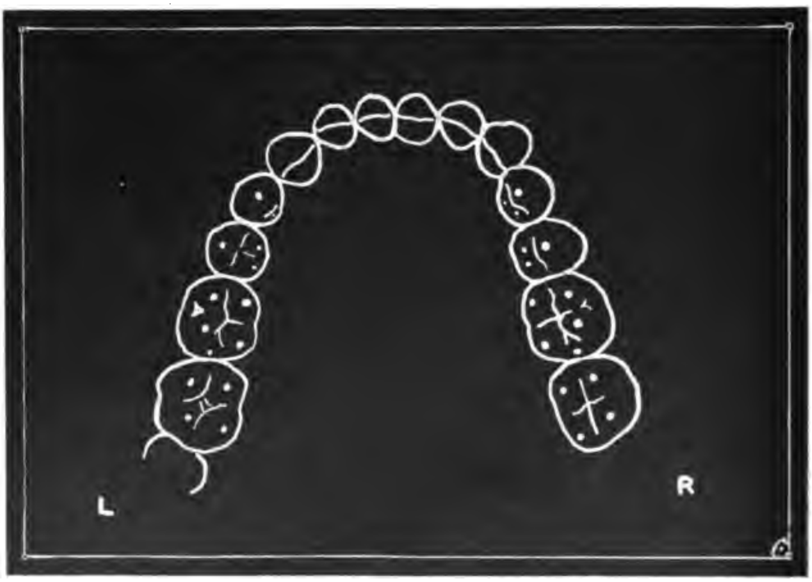


Fig. 17.—Plate 4 (D). Photo-survey of lower arch, supernumerary extracted.

During the early stages of my work, it was impressed upon me that it was advisable to reconstruct the arch, on the assumption of course, that it should be done with the least tooth movement. I have found, and hope to prove to you in the near future, that such a dogmatic rule is erroneous.

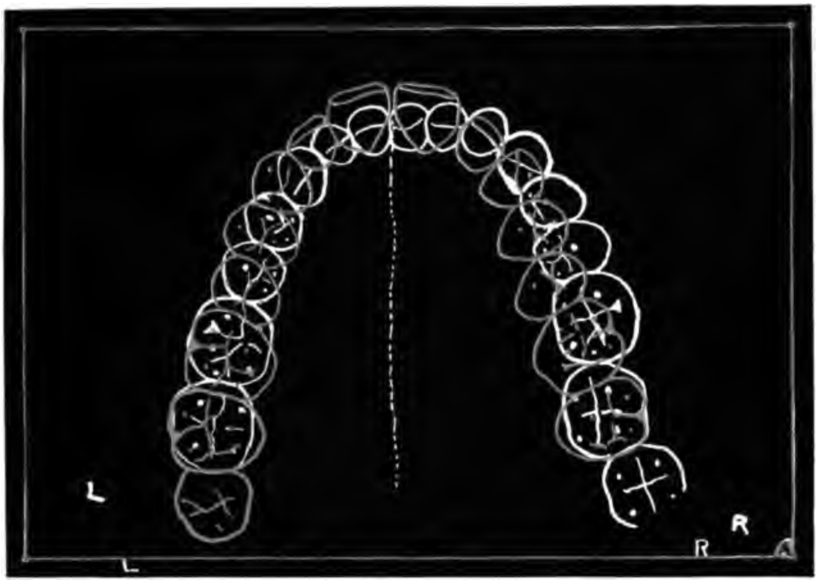


Fig. 18.—Plate 5. A and B in their occlusal relation. Plan view of the teeth in their malocclusal relation. Case before treatment.

Fig. 19.—Plate 6. C and D in occlusal relation. Plan view of the teeth in semiocclusal relation. Case under treatment.

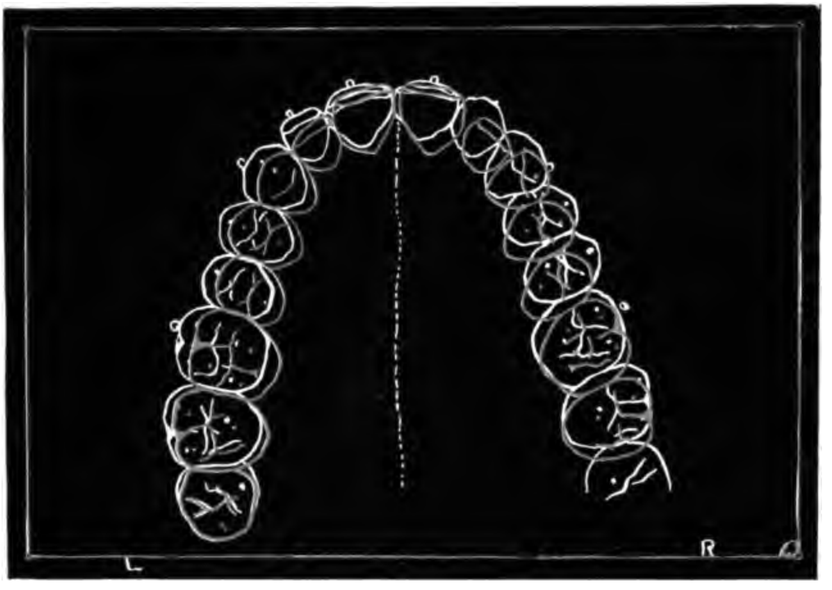


Fig. 20.—Plate 7. Plan view of upper arches (A and C) brought into relation to show change of position of the upper teeth.

Fig. 21.—Plate 8. Plan view of lower arches (B and D) brought into relation to show corresponding change in position of the lower teeth.

Either one of the analyses given, or a combination thereof, may be accepted as correct, *but that is not the issue. Through cooperation of the orthodontist and the dental engineer, the question could easily be settled.*

It was intended to show that photo-surveys are an aid to the orthodontist inasmuch as they represent valuable records which permit accurate research and offer a concise basis for discussion and interpretation of the orthodontists' aims and accomplishments.

DISCUSSION

Dr. W. A. McCarter, Topeka, Kansas.—Mr. Hanau has been working out for us, along mechanical engineering lines, a system of dental arch measurements and his photographs in connection with his work are very valuable. What I have to say will be about the method of taking photographs which I have used in my office merely for making records. Dr. Lischer suggested to us a few years ago the importance of keeping good records of our cases, and further suggested that the photographic method would be a perfect way of enabling us to do that. At one time, Dr. Dewey in a lecture showed front and side views of a patient in order to get an expression of the face, and a profile view, and I conceived the idea of combining the two and making profile and front view pictures at the same sitting. I have here a few slides illustrating this method. The work has been done entirely in the office. As I have a small operating room about ten by seven feet in dimensions, I try to condense everything, and I take the picture in two mirrors. Fig. 1 shows the interior view of the office.

Fig. 1.

Instead of taking one side of the face, I arrange a double mirror to get both sides of the face at the same time. In this corner, where the door leads into the operating room, I have attached a mirror to the door, and another mirror at a right angle on the wall. Two shaded lights are placed to reflect the light on either side of the face. The subject is seated on a stool in the angle between the two mirrors, facing the camera which is set about six feet from the mirror. Thus a picture is secured of a direct front view and both sides of the face at the same time.

Fig. 2 shows a picture taken with a double mirror. Sometimes there is a little difference in the two profile views of the patient. I take them both in one picture merely as a record.

In the same manner with the same mirrors a picture of the model is taken. By it is shown both right and left sides of the occlusion as well as the front (Fig. 3).

Mr. Hanau has shown us an illustration where he had a "multiview" picture. He took two separate pictures and put them together. By my method the same result is obtained with one exposure.

In taking pictures, Mr. Hanau has explained from a mechanical engineering standpoint that we have to have angles in a certain position. One of the mirrors which I used is fastened to the wall and the other is fastened to the door. I can change the focus of the reflected image, by increasing or diminishing the angle. With an angle of 45 degrees

Fig. 2.

Fig. 3.

Fig. 4.

the profile reflection in the mirror is distorted, making it smaller than the front view. By having one of the mirrors on a hinge you can bring them closer together and get pictures of the same size.

Fig. 4 is a picture I showed last year at Pittsburgh. You may remember it. It was taken with two small mirrors, and a light camera. I think it was one of the Eastman kodaks, about No. 3-A. It is one of those things that is handy and can be set up anywhere and a picture taken with it.

I have shown you my system of taking pictures. It is a very simple and inexpensive way of keeping records.

Mr. Hanau.—The method Dr. McCarter employs is excellent for large objects and probably the most convenient, but it is limited in its accuracy, unless special provision is

made to compensate for the perspective. It must be kept in mind that the ordinary photograph is a perspective and that the side views are images, therefore, the right side view appears to be a left profile and vice versa. If it should ever be necessary to eliminate the latter defect, then I suggest that films instead of plates be used, and the film be reversed (that is, the side views only) when printed. As a relative record, I do not doubt that the pictures Dr. McCarter showed fully serve their purpose. I know that a photograph which ordinarily is a perspective is a rather inconvenient base from which to make absolute measurements and I have found it to be most unreliable and deceiving.*

Dr. R. Waldron, Newark, N. J.—In discussing this paper by Mr. Hanau which I did not receive until today I find it entirely different from its title and what I had expected it to be, therefore, I am not prepared to talk upon it as I would like to.

Mr. Hanau has shown us a photographic apparatus and has urged the importance of taking photographs of our cases for arch predetermination. Here I disagree with Mr. Hanau, for it is not necessary to have an engineer to compute all our cases, and when we do seek his services, he should make these orthographic projections of the models sent to him, for accuracy must be followed in every detail.

Mr. Hanau speaks of the superiority of the photographs as compared with the charts made with the surveying instrument. I purchased one of these surveying instruments and I am frank to say that I do not use it, for when I have a case which necessitates a survey I send my models to the engineer and let him use whatever method he pleases. All I am concerned in is his ideas of the solution of the problem, and then I am governed by my own judgment.

The question has been raised with reference to one type of arch. You know and I know that when we have a dental arch in malocclusion we can regulate the teeth to our satisfaction and to the satisfaction of the patient. Another man may take the same case and get a beautiful occlusion with a slightly different shaped arch by placing the teeth in a slightly different position.

As to the value of photographs of this work presented by Mr. Hanau, we have a great many doubting Thomases, but I am thoroughly convinced it has its place in the small minority of cases. for with the tooth material of one jaw harmonious in size with those of the other I believe these surveys are unnecessary.

Dr. Hawley had a case and very soon found out that he had an excessive amount of tooth material on the lower six anterior teeth. He extracted one of the lower laterals and obtained a beautiful occlusion. Later he sent his models to the dental engineer who suggested as one solution of the problem the extraction of that particular tooth which Dr. Hawley had removed.

As the other solution of the problem he recommended we have an end-to-end bite of the anterior teeth, and this you know was impossible as the forces which govern occlusion would be seriously interfered with, and therefore, we could not expect to preserve the integrity of the arch by so doing, for the normal over-bite has a great deal to do with the same and the normal approximal contact of the teeth would have been destroyed.

I have a case at the present time on which I have been working for two and a half years. The molars and bicuspids are in beautiful occlusion with sharp deep cusps, but I can not place the six lower anterior teeth in the arch and get occlusion. After measuring these teeth and spending considerable time in the study of this case I came to the conclusion that there is an excessive amount of tooth material in the lower six anterior teeth. The best way I thought to deal with this problem was to rotate the lower canines, which I did, and after doing so, I slightly rotated the laterals and then there was too much material, and I am sure that the only way in which to get occlusion is the removal of one of the lower teeth. I intend to send this case to Mr. Hanau and ask him which tooth he would extract to bring about the best results.

These cases are a very small percentage of those which we are called upon to regulate, and I think such cases should be sent to these men who style themselves dental engineers, but I do think it is a waste of time and money to send all our cases to these gentlemen when we can get results that are both satisfactory to ourselves and our patients without their cooperation.

Dr. B. W. Weinberger, New York City.—We are talking about extracting, where we have five incisors, a certain tooth, especially a lateral, to obtain occlusion. This model here (indicating) shows as nice an occlusion as I have ever seen. You will notice, of the five lower incisors, outside of the central one, there is no overlapping, and that one only a trifle. There are no means we can use to obtain a better occlusion than we have there.

*The reader is referred to the article, Multi-view-orthophotography, in the JOURNAL, iii, p. 142.

If we extract a tooth, what is the result? I have two cases in my own practice with five lower incisors that have "normal" occlusion, probably one of those types of cases where the upper tooth substance has been taken care of by Nature enlarging it to compensate for the lowers.

Mr. Hanau.—That is almost an end-to-end bite.

Dr. Weinberger.—Nature has compensated for that by decreasing the labio-lingual distance at the median line.

Dr. Waldron.—There is considerable depth to the bicuspids on this side.

Dr. Weinberger.—Yes, the molars as well, but those teeth are all in occlusion and articulation, on both sides.

Dr. Waldron.—There is considerable overlapping of the lower incisors.

Dr. Weinberger.—Very true, but only the center one. I would not extract a tooth like that. This is the skull of an Indian who was forty or fifty years of age. As you can see there is a pyorrheal condition, nevertheless, a majority of us wish we had as perfect an occlusion.

Dr. Waldron.—There was abnormality of the five incisors—an excessive amount of material.

Dr. Ray D. Robinson, Los Angeles, California.—It has been my experience that the teeth of one jaw do not harmonize with those of the other in size in but rare cases. I want to go further and say that the two lateral halves of the arches do not correspond in the measurement of the teeth. There is the greatest latitude there. I had one case where one central incisor was three millimeters wider than its mate. I can show you bicuspids from one to one and a half millimeters wider than the corresponding bicuspid on the other side. It is rather rare to find cases where the two lateral halves of the arch correspond in measurement. It is the great latitude which we have in the amount of over-bite that permits us to get anything like normal occlusion.

Dr. C. A. Hawley, Washington, D. C.—This work of Mr. Hanau's impresses upon our minds the fundamental conception of the relations of the teeth which Dr. Robinson has spoken of. If any man starts out with the idea that the teeth in the upper and lower jaws, or even the lateral halves of the same jaw are in absolutely accurate relation, if he takes measurements he would have that idea taken out of his head. All the variations Dr. Robinson spoke of occur. Some twelve years ago, I measured a good many teeth to establish the arch. I took a large number of measurements of the mesio-distal widths of different dentures from molar to molar and laid them out on a straight line one after the other, upper and lower, supposing, of course, there would be uniform variation in the length of the lines of the lower and lines of the upper, but there was nothing of the kind. I did not go any further to work out the amount of variation.

I am impressed very greatly with the value of Mr. Hanau's work, and especially when he lately shows that there are several arches in which teeth can be practically placed. When Dr. Stanton told us as the result of his investigation, that there was only one arch in which the teeth could be placed in proper occlusion, I think every man with experience hesitated to accept it.

I wish this matter could be simplified, and it seems to me it can be. The range of that variation which would influence our treatment occurs, if I understand Mr. Hanau rightly, anterior to the first bicuspid tooth; that is, it occurs in the front teeth. If we take the sum of the sizes of the upper and also add the sizes of the lower and then divide the lower by the upper, we get certain ratios which, together with consideration of the labio-lingual distances, will enable us to establish occlusal relation. A change of either factor must change the shape of the anterior curve.

I want to correct the impression that Dr. Waldron gave you in regard to that particular case. I did not work on the case for a long time before I reached a conclusion. This young lady came to me; she was twenty years of age, and I could see at a glance there was something unusual. I arrived at a conclusion in this way: I measured the upper six front teeth and laid the measurements down with a pencil on a curve; I drew on a piece of paper a curve I thought the arch ought to take. It was the curve of a Bonwill arch. I laid on that curve just the widths of the six anterior teeth; then I took the distance from the incisal edge of an incisor down one-third the lingual slope where the edges of the lower ought to be. I drew a curve of the lower teeth at that point and measured off the lower teeth on that line. I could see at once we could not get these four incisors in that curve. But I made another one and put in three, and that went in exactly. I extracted the lower incisor and obtained my result. I talked over the case with Dr. Waldron, and the case went to Mr. Hanau and his surveys corroborated the result. I exam-

ined two models belonging to a friend of mine, an orthodontist, who was struggling over these cases. He had been treating them some time and could not get an overbite. We went over them in the same way, and I decided that the only way to get a normal overbite was to extract a lower incisor. He did not do it. He thought that these teeth were exactly proportionate, but he never secured good occlusion. To treat my case and get an end-to-end overbite would have been foolish. You can not do that sort of thing. You could not do it for this lady without producing a disproportion in her features which would not be permitted.

I had another case which Dr. Waldron spoke of in which the reverse condition occurred. This case had been treated a long time. I had too much tooth material in the upper jaw. Mr. Hanau surveyed and corroborated the condition. I wish there were five lower incisors in this case, but they are not there, so I started to move the six anterior teeth forward and leave a little space between the lower first bicuspids and cuspids. In that way I can get a normal overbite and normal occlusion.

Mr. R. Hanau.—Dr. Waldron very correctly stated that it is unnecessary to survey every case. It was not my intention to convey the idea that it would be necessary; however, I wish to urge you to study and understand surveys, not only as such, but as a means of investigation and planning. You may then foresee the changes in occlusal relation for certain changes in the arrangement of the tooth units or groups. For instance, you will be able to solve the problem of how to produce a more pointed or blunt arch form (change of the compensating contact curves) by changing the relation of the teeth in one or both jaws; also how to overcome defects in the occlusal relation about the cuspids or any other part of the denture.

I realize the course I suggest seems a difficult one, inasmuch as it involves descriptive geometry which is not included in the curriculum of dentistry or medicine, and is not particularly attractive to those who did not have the occasion or time to familiarize themselves with the subject. Nevertheless, I believe I may presume that upon studying descriptive geometry, you shall soon know more about it than I do about orthodontics. I assure you, you need geometry more than I do orthodontics! Why? As orthodontists, what are you doing? Simply performing engineering work in small space; and, one of the main axioms of engineering is descriptive geometry.

I wish you would give this subject more serious consideration. I believe it shall be to our mutual advantage. It would stimulate further investigation and no doubt lead to some very valuable results.

I greatly appreciate your attention and heartily thank you for the interest taken in this subject.

THE INDIRECT METHOD OF ANCHOR BAND CONSTRUCTION*

By Martin Dewey, M.D., D.D.S., Chicago

In giving to you the indirect technic of making bands for orthodontic purposes, I do so because it is my belief that in a large number of instances a more accurately fitting band can be made and be made with much greater ease to the patient by the indirect method than if made directly over the tooth. I am aware that there are a great many operators who can make bands directly over the teeth which fit very nicely and which are perfectly satisfactory both to the operator and to the patient. Nevertheless, the fact remains that those bands which appear to be perfect if placed upon a metal model of the same tooth could be more accurately fitted by being swaged according to the indirect method than they fit when made directly over the tooth and contoured and burnished. It is a well-known fact that any piece of metal can be more easily adapted to a surface by being swaged than it can by being burnished.

You are also more or less familiar with the arguments which have been going on among dentists in regard to the advisability of making inlays by the direct or indirect method and each plan has a large number of advocates. However, everything considered, I believe that a more accurate adaptation can be made by the indirect technic in orthodontic work, especially the bands on molars and premolars, than can be obtained by making the band directly over the tooth. The methods which I give to you today are by no means original to me as I obtained them from conversation with and observation of other men. In making bands according to the indirect method we have the band technic which has been described by Dr. Mershon where the band is made over the plaster tooth. This method has been previously described in the Journal.

Today I will confine myself to the swaging of bands over metal models and give you two plans of obtaining the model by the indirect method for your consideration. These plans differ in that one uses a modeling compound impression with an amalgam model, while the other uses a plaster impression with a Melotte model. In taking a plaster impression for making a band by the indirect method as described to me by Dr. Schroeder we use a tray for the purpose of obtaining an impression only of the tooth that is to be banded and the approximating teeth. Before taking an impression of the tooth that is to be banded we slip two pieces of metal between the approximating teeth and then take the impression in plaster. The impression on the right of Fig. 1 shows the impression as it is removed from the mouth with the strips of band material in between the teeth. As we desire a model only of the tooth to be banded, the impression of the approximating teeth is filled in with moldine as is shown at the left of Fig. 1. If we desire to increase the length of the tooth, it can be accomplished by carefully building a rim of moldine around the gingi-

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 7, 1917.

Fig. 1.—Impression for indirect band-making, showing pieces of metal between teeth and approximating teeth filled with moldine. (Schroeder.)

Fig. 2.—Metal models of single teeth. Models of anterior teeth made with strip of metal between teeth. (Schroeder.)

Fig. 3.—Thin copper band trimmed to festoon of gum.

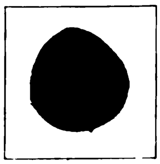


Fig. 4.—Impression of tooth in compound.

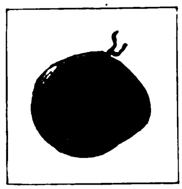


Fig. 5.—Impression with celluloid strip wrapped around it.

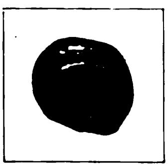


Fig. 7.—Copper amalgam model of tooth.

Fig. 6.—Impression invested in plaster.

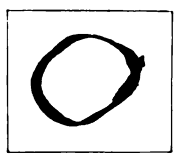


Fig. 8.—Band soldered with lap joint.

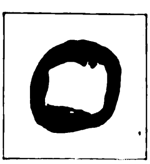


Fig. 9.—Band swedged.

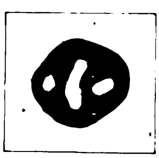


Fig. 10.—Band with cusp soldered and cut out for occlusion.

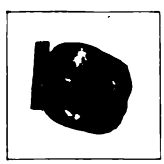


Fig. 11.—Crown with tube and lug.

Note: Figs. 3-11 were supplied by Dr. W. A. Coston, of Topeka, Kansas.

val border of the impression which will increase the length of the tooth and enable us to fit the band much more accurately around the gingival margin of the tooth than we would if the gingival gum tissue were reproduced in metal. After the impression has been packed with moldine, the model is made from Melotte's or Babbitt's metal, which is shown in Fig. 2.

A wire measurement is then taken of the metal tooth. A piece of band material the proper length is cut, which can be swaged and adapted to the metal tooth. This swaging can be accomplished by a horn mallet or can be accomplished by placing the tooth and the band in a small plunger's swager such as used for crowns and bridges. If it is desired to make bands upon the anterior teeth, an impression can be taken of them in the same way as an impression was taken of the molars with pieces of band material placed between the teeth (Fig. 2). If pieces of band material are placed between all the anterior teeth, it will be possible to obtain a metal model of the six anterior teeth upon which bands can be fitted.

Another method of making bands over metal models is described by Dr. Coston and I will only outline his technic briefly as he is here to speak for himself. According to this plan a copper band is made for the tooth, trimmed and festooned so as not to injure the gum (Fig. 3). This band need only fit approximately as it is to be used as an impression tray to carry the modeling compound which is to take the impression of the tooth. Fig. 4 shows the impression of the tooth in modeling compound. As we are going to make an amalgam model of a tooth and desire a sufficient length of the metal tooth to be convenient for handling, a strip of celluloid is wrapped around the tooth or the impression of the tooth as is shown in Fig. 5. The impression is then invested in a plaster investing ring as shown in Fig. 6. After the impression is hard, the modeling compound impression as invested in the plaster ring is packed full of copper amalgam, which gives a copper tooth as shown in Fig. 7.

A piece of band material is then cut to fit around the tooth, and is generally cut with the ends on the bias. The end of the band can be soldered, either pinched or lapped, but a lapped band is preferable in the swaging process (Fig 8). The band is placed upon the metal tooth and the same placed in a swage and swaged, which results in the bands being properly adjusted and adapted to the tooth (Fig. 9). This plan of swaging bands is especially desirable on deciduous molars because a much more accurate fit can be obtained and because the bands can also be made with less pain and less annoyance to the patient than if made directly in the mouth. In some cases where the molars are short or the crowns are faultily calcified, it may be desirable to swage a cusp over the metal tooth for the purpose of making a band which has an occlusal surface. If this occlusal surface of the band interferes with the occlusion after the band has been cemented on, it can be cut out with a stone as shown in Fig. 10.

Such attachments as are necessary can be made on the band as shown in Fig. 11, including a buccal tube on the buccal surface of the band. It will also be observed that there is a small tube soldered on the lingual side which is for convenience in removal of the band. The swaged band fits so accurately that

it is difficult to remove it from the tooth if the band is tried on before being cemented. The spur is soldered on for the purpose of assisting in the removal of the band during the period the appliances are being fitted. I have found that these bands fit much more accurately than any band which I have ever observed, and we believe that the accuracy can only be appreciated by those who try them and use them in their practice.

DISCUSSION

Dr. W. A. Coston, Topeka.—I do not know that it is possible for me to add anything to what Dr. Dewey has said in regard to the making of these bands. I have had a great deal of comfort and pleasure myself in making them by the indirect method, as we have had in the general practice of dentistry a great deal of comfort and benefit in the making of all restorations by the indirect method. It almost goes without saying that the making of anything to be cemented in the month, or to be set in, that is removable in any way, can be made more definitely by the indirect method than by the direct method. Of course, many years ago we applied the indirect method in the making of all artificial dentures. We think a man is probably an extremist who would claim he can adjust a plate to the mucosa as easily as he could to a plaster or a metal model, and while it may be an unfair comparison, it is to a degree true of anything we make in the way of restorations in the mouth, and equally true in making anchor bands in orthodontia, provided one feels that accuracy of fit is desirable. We know it is true that all sorts of plain bands are adapted, after a fashion, to teeth in this work, and they seem to accomplish what we desire of them; but on account of the occlusal constriction of teeth, which is so noticeable in temporary molars, it is practically a physical impossibility to ever adapt a band to teeth properly and closely.

The use of copper amalgam in the making of the model is purely for economic reasons. Any amalgam would do as well. In my experience there is no comparison in the accuracy of a model made by pouring metal, or casting, and one made by forcing amalgam into a matrix. The impression is made by taking a copper band that is made in twenty sizes, and from one-third to one-half of an inch long, very thin. They can easily be adapted to the teeth loosely. Cut away the band on the approximal surfaces to accommodate the gingivæ, and make very thin approximately, and then fill with modeling compound. After being softened with heat, the band filled with compound is forced to place. The compound is confined by the band, and you get a very accurate impression of the tooth all the way to the gum line. The modeling compound is confined and can not get away, and you can make as good an impression or better than you can make with plaster of Paris, probably. It is invested in plaster of Paris so that you have a receptacle into which you may pack your amalgam with a good deal of force, and the copper amalgam is made thin and packed in place. The result is practically a perfect model of the tooth upon which you can fit any band with more accuracy than you can fit it in the mouth. You can make them very thin so that, as Dr. Dewey says, they slip on the teeth and go quickly to place. When made of heavy material, it affords the possibility of having the band so accurately fitted that in a child's mouth it goes to place without any trouble, without any pain, and without wounding the investing tissues.

At the clinic I will show you the method very much better than I can possibly explain it to you.

Dr. C. A. Hawley, Washington.—I do not know that I am in a position to discuss this paper. I did not see it before it was read. My impression is that this technic is altogether unnecessary. So far as fitting bands in the mouth is concerned, I can put bands directly in the mouth, while they are getting the material ready. So far as fitting them in a child's mouth or anybody's else mouth, where the proper separation is made beforehand, I do not see any reason whatever for using the indirect method for that purpose. I have a young man in my laboratory who makes them first on a plaster model. I use plaster, and you can make a plaster model in one-fourth of the time, and there are very few that do not fit in the mouth. If they do not fit to suit me, as they are made of iridio-platinum, soldered with pure gold, I can open and change them while you are pouring one of these indirect models of metal.

So far as time saving is concerned, I do not see any advantage in it either for the laboratory man or the man at the chair.

I do not know that I have anything more to say other than to call your attention to what I presented last year in a paper I read at Pittsburgh. I have not seen any of these bands, but you can not make metal models either of amalgam or any metal without stretching the band, and it does not fit better than I fit them in the mouth in one-quarter of the time. So far as an absolute fit being hard to remove, I have fitted many bands in the mouth that any one would have hard work to pull off. I have broken many an excavator trying to pull them off when fitted directly in the mouth.

Dr. Coston.—Of course, we know that bands can be crimped in under the gums many times so that they will stay there for an indefinite time, and very many times to the detriment of the investing tissues, and the only contention I have is making bands that fit with reasonable accuracy which protect the soft tissues, enabling one also to make a band that does not interfere in any way with the occlusion, which is impossible with a straight band because the constriction is so great that crimping in of the band over such a tooth leaves fissures and wrinkles, while by the swaging process there are no wrinkles. They can be made to fit so that they work all right, just as we do many things that work all right.

Dr. Fisher.—How long a time do you allow for making an amalgam model before you let your laboratory man work on that model?

Dr. Coston.—Copper amalgam takes six or eight hours to crystallize.

Dr. Fisher.—You would not have to do it the next day?

Dr. Coston.—No. I have my laboratory man make it so that it will fit, and whether I put my bands on today or tomorrow is not a matter of great importance.

Dr. Manly Bowles, Winnipeg.—The method I use is as follows: I make an overlapping clamp band, in some cases the ordinary clamp band that you may purchase will do, fit it on the tooth, burnish it, and remove. Then solder together the overlapping ends, at the same time removing the clamp. Frequently, however, in the ordinary clamp band we find that where the clamp is soldered to the band it is flattened and widened to such an extent that it is hard to burnish the band to the tooth. I then make a clamp band having the screw portion of the clamp bent sharply at right angles and not flattened. With children I take an impression in modeling compound, obtain a cast in hard plaster, and trim as described by previous speakers. I then fit and burnish my band to this model. I am not worried if the model is not absolutely accurate as the final tightening and burnishing of the band will be done in the mouth.

INCOME TAX INFORMATION FOR DENTISTS*

By Clarence O. Simpson, M.D., D.D.S., St. Louis, Mo.

THE Income Tax Act of 1917, levying on all incomes over $2,000, and those of the unmarried over $1,000, will apply to many professional men not affected by former income tax laws. There being certain distinctive factors to consider in computing the net income of dentists, the following general information and special interpretation was obtained from the collector of internal revenue to aid the profession in making returns.

GENERAL INSTRUCTIONS

If you are married and live with your wife (or husband) and your net income for 1917 equaled or exceeded $2,000, you must make a return. If you are not married, are not the head of a family (actually supporting one or more individuals closely related by blood, marriage, or adoption), or not living with your wife (or husband) and your net income for 1917 equaled or exceeded $1,000, you must make a return. Send the return to the collector of internal revenue for the district in which you live so that it will reach him on or before March 31, 1918. The address of the collector of internal revenue and the form which must be used for the return may be secured from any post office or bank.

PENALTIES

The maximum penalty for failing to make return before specified time, is a fine of $1,000 and in addition 50% of the amount of tax due. For making false or fraudulent return, a fine of $2,000, one year's imprisonment, and in addition 100% of the tax evaded. For failing to pay the tax when due, 5% of the amount unpaid, plus 1 per cent interest for each month during which it remains unpaid. All provisions of the act will be rigidly enforced, no excuses will be accepted, and the lax methods permitted in the making of personal and realty tax returns will not be tolerated.

AMOUNT OF TAX

Unmarried persons must pay 2% on net income over $1,000, and 2% additional on all over $3,000. Married persons or heads of families must pay 2% on net income over $2,000, and 2% additional on all over $4,000, less an exemption of $200 for each dependent child under 18 years of age. In addition a surtax of 1% must be paid on income over $5,000, 2% over $7,500, and 3% over $10,000. There is an increasing rate up to $2,000,000, but any exclusive dentist with a five figure income should not waste his valuable time or risk his mental poise by sordid calculation, and any "popular price," general practitioner who has "speeded up" to more than $10,000 need not worry about income tax, the administrator will attend to this along with the other details in closing the estate.

*Excerpt from the President's address read before the St. Louis Dental Society, Jan. 8, 1918.

EXAMPLES OF APPLICATION

Unmarried with	$1,400 income	Unmarried with	$4,600 income
Exemption	1,000	Exemption	1,000
2% on	400 = 8.	2% on	3,600 = 72
Total tax	8.	2% on (over $3,000)	1,600 = 32
		Total tax	104

Married with	$2,400 income	Married with two children and income of	$5,600
Exemption	2,000	Exemption	2,400
2% on	400 = 8.	2% on	3,200 = 64
Total tax	8.	2% on (over $4,400)	1,200 = 24
		1% on (surtax)	600 = 6
		Total tax	94

FACTORS IN DETERMINING INCOME

The gross income from a dental practice is the total receipts during the calendar year of 1917, unpaid accounts whether collectable or not should be omitted. The net income is the total receipts, less the expenses of conducting practice during 1917.

EXPENDITURES ADMISSIBLE

The following items are considered legitimate expenses of conducting practice:

Office rent.

Heat, light, water, and janitor service. (Unless included in rent.)

Assistants.

Materials, including precious metals and all supplies, except equipment and appliances serviceable for more than a year.

Laundry.

Insurance. (Fire, tornado, and liability, only.)

Dental society dues, expense, and contributions.

Necessary expenses in attending dental meetings.

Cost of postgraduate courses during 1917.

Dental journals.

Cost of collecting accounts of 1917.

Interest on notes for equipment.

Taxes paid on equipment, furniture, and supplies in 1917, except special assessments for local improvements.

Depreciation of office equipment, furniture, instruments, appliances, and scientific library. (This includes some articles serviceable for a long period and others which from wear or subsequent improvements must be frequently replaced, and 25% of the cost is permissible.)

Losses by fire, storm, or theft, not covered by insurance.

EXPENDITURES NOT ADMISSIBLE

The following are items which have been, or might be, considered as expenses of conducting practice, but are *not* so construed in the provisions of this act:

Interest on investment.

Interest on the cost of professional education.

Refund on investment.

Salary or expenses of self or family.

Accident, health, or life insurance.

Cost of equipment purchased during the year. (Deduct only for depreciation.)

Uncollected accounts. (Should not be included in gross income or deducted.)

These instructions apply only to the income derived from practice, and income from colleges, postgraduate instruction, appliances, patents, books, stocks, bonds, property, notes, mortgages, bank deposits, or other sources must be included under the proper heading.

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EDITORIALS

Service Versus Results—A Question of Orthodontic Fees

ONE of the most difficult problems confronting the man taking up orthodontia as a specialty is the question of arranging the fees. We realize that a great deal of space has been given to the question of dental fees by writers upon the subject of business as related to dentistry, but many of these articles have not been satisfactory from the point of every one concerned because they have failed to reach the real basis for naming the fee. Many plans and methods have been adopted, but the majority have not been satisfactory to both the patient and the operator.

Orthodontics, as well as any branch in medicine, is based upon the service rendered the patient, and surely the fee should also be charged on this basis. Consider for an instant the average orthodontist who undertakes the treatment of a case of malocclusion. He is very often obliged to promise the patient a

certain definite result; he bases his fee on that promised result and charges for the length of time that will be spent in the correction of the case and what the correction will be worth to the patient in the end. Both of these factors should be considered, but the real solution of the problem is that the patient should pay for the service rendered. Then, if the question of what that service is worth to the patient, comes up, one has a perfectly logical proposition upon which to work.

We have known of a number of cases of malocclusion in which treatment was attempted and satisfactory results never obtained because the patient continued traveling from one place to another during the time of the treatment. The operator has spent considerable time and energy and still has not accomplished the same results as he would have if the patient had stayed under his treatment; however, the patient has been greatly benefited. There are cases in which the patient refuses to follow the instructions of the orthodontist, fails to keep appointments, and consequently limits the results, nevertheless, the orthodontist expends as much energy or more than if he had the cooperation of the patient. We also find malocclusions in which it is possible to obtain a practical result, but, owing to the deformation of some teeth—the improper size or improper cusp development—an ideal and normal occlusion will never be accomplished. If the orthodontist has been so short-sighted as to promise a normal occlusion in such a case, it will be impossible for him to accomplish that result; however, the result which he may obtain will be a practical occlusion, one which, from the standpoint of service, will probably render 95 per cent efficiency and be nearly as satisfactory as if the teeth were absolutely ideal and normal. In such cases as these mentioned, if the fee has been based upon the service rendered, there can be no argument, because a valuable service has been rendered, and all that possibly could be obtained under the existing conditions has been given. It must be remembered in the correction of any case of malocclusion that the improvement of the condition of the teeth is a valuable service rendered for which the orthodontist should be paid, even though conditions are present which made the establishment of normal occlusion impossible.

We believe that a great many orthodontists have handicapped themselves and placed themselves to a disadvantage professionally by promising a definite result to a patient, which in the majority of cases can be accomplished, but which in some instances, owing to conditions over which the orthodontist has no control and which can not be foreseen until treatment is commenced, will never be satisfactory to the operator from the standpoint of his ideal.

We, therefore, believe the solution of this problem is for the orthodontist to base his fee upon the service rendered the patient, instead of upon a promised result, which in some cases can not be obtained.

The Universal Regulating Appliance

WE have often called attention to the fact that there are those in the practice of orthodontia who try to find or design a regulating appliance capable of correcting all types of malocclusions, and some designers have placed on the market appliances for which they make this claim, as well as to state that they require little attention from the operator. Most of these appliances

so designed have been advertised by manufacturers, and as the sale of the appliance necessarily increases the income of the designers, we are often led to wonder if some of the assertions made are even believed by these men themselves.

The practice of orthodontia has been retarded many years by attempts to force upon the profession certain styles of appliances or to confine the practice of orthodontia to the use of some particular kind or style of appliance. This practice will place orthodontia in the same stage that medicine was when one drug was considered for treatment of all human ills. While it is true that malocclusions can be classified and placed in a. few groups, it is equally true that their correction often requires very different treatment and styles of appliances. An appliance may be satisfactory for a case if used on the patient at the age of seven, but will not be suitable for the same case at the age of seventeen. In other words, conditions change even in the mouth of the same patient, and make the use of an appliance possible at one time and impossible at another. Only recently a new appliance has appeared and been widely advertised, the principal feature of which is that it may be put on and it does the work unaided. If every tooth moved exactly the same and every case required the same amount and degree of force, there might be some possibility of designing an appliance that would work satisfactorily in all cases of malocclusion without any attention on part of the operator. Malocclusions differ a great deal, and even those that appear to be similar require different degrees of force to produce movement in different individuals. We even find similar teeth in the same mouth that do not move with the same degree of rapidity. For these reasons designing a universal appliance and placing it before the public with the statement that it will do the work is at least misleading to a great many men.

We find that the appliances that do the work without any attention are also being advertised in a different manner. For several months past one of the dental journals has been publishing a series of articles dealing with a plan of diagnosis and methods of treatment. These articles have been followed up by advertisements indicating that if the methods advocated are followed, after the appliance is properly constructed, it can be placed on the teeth and with very little assistance will successfully treat the case. In other words, the authors of these methods and the constructers of these appliances would have the dental profession believe that if the plans laid down were followed, any one, regardless of his knowledge of orthodontics, could successfully treat a case of malocclusion. We do not attempt to decry the value of these widely advertised styles of appliances or the use of certain methods and plans of diagnosis, for all of them have a value; but we do believe it is misleading to send out the information that an appliance, if properly placed upon the teeth, will do the work without care and assistance on the part of the operator. Even if the appliance is properly constructed and placed on a model, it must be carefully transferred from that model and placed upon the teeth in the same position in order to accomplish anything like successful results.

The possibility of any regulating appliance automatically correcting a malocclusion is destroyed by the complications that present in the different resistances to tooth movement as well as different degrees of development, etc.

One of the most necessary things in the successful treatment of any malocclusion is the selection of the proper appliance, and this can only be made after careful study of the case and the principles of appliances. Therefore, we would recommend that an appliance be chosen because of its mechanical fitness for the particular case, and not because of some high-sounding advertisement of a manufacturer.

The Fifth Annual Meeting of the Pacific Coast Society of Orthodontists

ON Monday and Tuesday, February 18 and 19, 1918, the Pacific Coast Society of Orthodontists will hold their Fifth Annual Meeting at the Palace Hotel, San Francisco, California. The following program has been arranged:

Monday, February 18.

9:30 President's Address.
William Cavanagh, Portland, Ore.

Discussion opened by:
James D. McCoy, Los Angeles.

The Third Molar Influence on Orthodontic Cases.
H. L. Morehouse, Spokane.

Discussion opened by:
Robert Dunn, San Francisco.

A System of Orthodontic Records.
C. O. Engstrom, Sacramento.

Discussion opened by:
John R. McCoy, Los Angeles.

1:30 Natural Tooth Movement During Performance of Function.
Nye White Goodman, Los Angeles.

Discussion opened by:
Leland E. Carter, San Francisco.

Clinic.

D. Arthur Johnston, Los Angeles.
Frank E. Sarp, Los Angeles.
Some Suggestions as to Prophylaxis During Orthodontic Treatment.

3:00 Annual business session.

Tuesday, February 19.

9:30 Orthodontia in the Year 1918.
B. Frank Gray, Colorado Springs.

Discussion opened by:
William B. Powers, Seattle.

Dentistry for All the People.
Allen Suggett, San Francisco.

Discussion opened by:
A. W. Sobey, San Francisco.

Our Moral Responsibility.
Charles C. Mann, Seattle.

Discussion opened by:
W. R. Dinham, Portland.

1:30 *Clinics.*

C. O. Engstrom, Sacramento.
A Band Ring.

James D. McCoy, Los Angeles.
Appliances for the Bodily Movement of the Teeth.

W. R. Dinham, Portland.
(Subject to be announced.)

A. A. Solley, San Francisco.
Fractures of the Maxillæ.

Leland Carter, San Francisco.
Removable Orthodontic Appliances.

John R. McCoy, Los Angeles.
A Technic for the Construction of Plain Molar Bands.

Robert Dunn, San Francisco.
(Subject to be announced.)

William B. Powers, Seattle.
(Subject to be announced.)

Officers and Standing Committees for 1917-1918 are as follows: *President,* Dr. William Cavanagh, 808 Corbett Building, Portland; *Secretary-Treasurer,* Dr. John R. McCoy, 908 Brockman Building, Los Angeles; *Program Committee,* Dr. H. F. Sturdevant, Chairman, Dr. James D. McCoy, Dr. Allen Suggett; *Membership Committee,* Dr. Robert Dunn, Chairman, Dr. C. O. Engstrom, Dr. William B. Power.

Dr. George D. Kennedy

THE death of Dr. George D. Kennedy at his home in Colorado Springs, January 27, is sad news to his many friends in various parts of the United States. Dr. Kennedy occupied a high place in the dental profession and was well respected by the citizens of his city. He had been ill for over three years and it was hoped at times that he would eventually recover, but an All-wise Ruler deemed that he should remain with us only in spirit.

Dr. Kennedy was born in Centralia, Illinois, September 27, 1868. He graduated from the Washington University in 1891 with honors, being the youngest man in the class. He was married to Miss Bessie Linn in 1898.

He was a prominent Mason, a Past Master of El Paso Lodge No. 13 and Past Grand Master of the Colorado Grand Lodge. In 1913 he took the course in the Dewey School of Orthodontia. He passed the California State Board and intended to practice orthodontia in California, but owing to failing health he returned to Colorado. He is survived by his wife, mother, sister, brother, and foster daughter.

Dr. Kennedy was an exceptional student, and we feel that besides his death being the loss of a friend, the science of orthodontics has lost one of the brightest men that ever took up the work.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. IV ST. LOUIS, MARCH, 1918 NO. 3

ORIGINAL ARTICLES

FURTHER EXPERIENCE WITH THE .020 ARCH WIRE*

BY RAY D. ROBINSON, D.D.S., LOS ANGELES, CALIF.

IT is well known that until recently it was common practice among orthodontists to use the 16-gauge expansion arch; and as recently as 1914 in a paper read before the National Dental Association one of our leading orthodontists recommended the use of a 14-gauge iridio-platinum arch.

Nine or ten years ago, a number of men apparently about the same time reached the conclusion that they were using too much force, and began reducing the size of the wire used for the expansion arches. Being familiar with this trend in thought and practice, and having before me a difficult case, I conceived the idea of using the old Ainsworth principle of retainer as a working appliance, and to that end began the use of the 18-gauge iridio-platinum arch with pin and tube for the bodily movement of the molars and bicuspids when expanding the dental arch. This appliance was only used in a small percentage of cases, because I did not find it applicable to the anterior teeth, and did not find the way to either lengthen or shorten an intermediate section of the arch until later years. This same Ainsworth principle later came into great vogue when presented by another man as an original and revolutionary appliance.

The next step in the development of the appliance as I now use it came in 1911 when I began experimenting with 20-gauge in the form of a looped arch. These experiments were carried on with different forms and sizes of wires and different locking devices until 1914, when I published an article under the title, "A Looped Arch and Its Attachment," and later in the same year read a paper on this appliance before this society. In May, 1915, I read a paper before the Illinois State Dental Association, describing the use of the

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 6, 1917.

.018 tungsten wire and the .020 platinum-gold wire. In this paper was also mentioned the use of the flat wire, and in the illustrated talk which accompanied the reading of the paper a locking device was shown and reasons given why the flat wire would never, in my opinion, be a success. Since that time, as is well known, the same man, who presented the Ainsworth principle as his own original devise has presented another original and revolutionary appliance called the ribbon arch, the arch being the same and the locking device a slight modification of the device shown at the Illinois meeting. These may seem extraneous matters, but they are interesting side lights on the development of appliances.

As time has gone on I have found myself fully justified in the use of the smaller sized wires. It is now about three years since I have used any wire larger than .020. A proper wire of this size will develop all the force necessary to perform any movement of the teeth as rapidly as is consistent with the proper development of the bone for their support. It will not, of course, move teeth as rapidly as would the 16-gauge arch; but, when the period of retention is taken into consideration, the whole period of treatment and retention will average much less with the .020 wire than with the larger and more powerful appliances. The smaller wire also performs its work without the soreness which attends the use of the larger appliance, and this factor does not receive the attention which it deserves at the hands of most orthodontists. When it is stated that it is not necessary to produce soreness in correcting malocclusions of the teeth, the statement is absolutely true.

Bodily Control.—The operator's control is only limited by his desires, because it is only necessary to place the block on the wire at the angle to which it is desired to move the tooth and then spring the block into its seat and lock it there. While the pressure on the tooth will be very slight, it will be sufficient if given proper time to bring the tooth to the desired angle.

Technic.—Since my last article was published I have modified the technic by changing the method of attaching the block to the wire this now being done without soldering by making the attachment rigid only at the arch ends and by moving the arch from the bucco-labial side of the teeth to the palato-lingual side. This has not only made the appliance less conspicuous, but has greatly added to its efficiency, and much reduced the liability of breakage. The technic of construction and application is so simple and liability of error in either direction, or amount, of force is so small that it would seem that the average man could well handle the appliance. This does not mean that any student or dentist can purchase a coil of .020 wire and immediately become an efficient orthodontist, because as has always been the case, the most important thing in orthodontia, as in any branch of the healing art, is the ability to make a proper diagnosis. By a proper diagnosis, I do not mean merely the ability to tell whether a given case belongs to Division IV, of Section X, or whether or not it be a case of neutroclusion, but I do mean the ability to look at a case of malocclusion and in the mind's eye see the changes necessary to make it normal occlusion. I mean the ability to look at the abnormal and from it visualize the normal. The work of Angle and Lischer has been of great value in assisting orthodontists in learning to make correct diagnosis. But I

much fear that many depend on the letter of these classifications, and never catch the spirit of them, as in years past this same type of operator tried to make all cases conform to the size and shape of the expansion arches as purchased from his dental supply house.

But, granted a proper diagnosis; and treatment should never be discussed until that is granted; the construction and application of a proper appliance with the .020 wire presents fewer difficulties to me than do any of the other forms of appliances before the profession at this time. Once the size and shape of the desired arch has been determined, it does not seem a difficult matter to construct and apply a wire arch of the length and shape necessary to bring the teeth into the desired positions. The wire is small and can be readily bent into any desired shape, and being small and easily sprung, it can, after being formed into the size and shape of the true arch already determined, be made to assume the size and shape of the arch as it is with the teeth in malocclusion. If this be done and the wire arch locked into such positions, the resilience of the wire will slowly and gently move the teeth into their correct positions. It will do this with a minimum of attention on the part of the operator and a minimum of annoyance to the patient.

In those cases in which rotations are necessary, two wires are used,—one on the labial and one on the lingual side, each being made to conform, in shape and size, to that portion of the true arch which it is to occupy. This, as with the Lourie appliance, obviates the spaces between the teeth made necessary by the bands in those appliances which call for a band on each tooth to be rotated.

Locks.—In the evolution of this appliance I have made and tried nearly thirty forms of locking devices. The form I now use was devised in 1914 and has been in constant use since that time, although during that period I have made and tried various other forms, only to discard them. The lock is efficient. It will lock the wire and hold it rigid under the strain of moving the teeth and under the stress of mastication. It will, if properly locked, stay locked; and it can, at the operator's will, be unlocked. It can be locked and unlocked ***ad infinitum***. But it matters not whether the lock devised by me be used or some other, provided such other device will do the things which this will do. I believe some day a better lock than mine will be devised. I have clearly in my mind the requisites for a better locking device, but I have, so far, been unable to overcome the mechanical difficulties necessary to its production. I have made several forms that in the laboratory worked beautifully, but when put into the mouth, were failures.

The thing which I do wish to advocate is not this lock or that, but the principle of the little wire, the principle of the small amount of force that is constantly applied as opposed to the greater force intermittently applied.

The difference in the principles of appliances as I see them can best be stated as follows:

The old Angle expansion arch was a rigid appliance bent to conform to the outside of the ideal dental arch. To this rigid form the teeth were drawn by means of various forms of ligatures. The pin and tube appliance and the present ribbon arch are lighter. They may be said to be semirigid appliances

bent to conform to the teeth as they are in malocclusion. From time to time they are removed and bent to a form more nearly resembling the true arch. The appliance which I use is a nonrigid arch made to the size and shape of the true dental arch, but of material so flexible that it can be readily sprung to the size and shape of the arch as it is with the teeth in malocclusion, and so resilient that it will, when properly locked to the teeth, carry them toward their proper places. If we could have a wire with 100 per cent of resilience, this is all that would be necessary; but as we have no such wire, it becomes necessary to reshape the arch at intervals. Its advantage over the heavier semirigid appliance is that the smaller wire can be so adjusted that it will work through a long range of distance and over a long period of time without at any time exerting more than a very slight pressure. This can not be done with the heavier appliances, and it is this which assures that the work will continue even though the patient be away from the operator for a long period of time, and it is this same characteristic which permits great movement of teeth without the soreness which attends the use of the heavier and more violent appliances and those which are intermittent in their action.

I see those of my patients who live in my home city but once each month; those who live in other places, three or four times in a year, and in one instance the appliance was put into place and circumstances were such that the patient could not return for more than a year. Although this required a complete reshaping of both dental arches when she returned, the work was found complete except that an erupting tooth had been allowed to go inside the arch wire. One adjustment of the appliance completed the work to everybody's satisfaction.

DISCUSSION

Dr. D. W. Flint, Pittsburgh.—It was my pleasure to spend some time in the office of the essayist, and in discussing his paper I can vouch for what I have seen, and from what we saw last night from our old friend Dr. Case, a great evolution has taken place in the sizes of wire we use. From the very large arch wire we have come down to the almost ridiculously small wire as Dr. Case showed us last night. There is one thing to remember, however, and that is, in talking about small (alignment or arch) wires, they can not be used by every person because there are some people who will not take the time to study force. The smaller the wire you use, the more care you have to use to see that it does not exert force in a place where you do not want it. In using small wire, if you are not watchful of its force, you will get into trouble in handling it. I have seen excellent work done by this small appliance, which was a revelation to me. I have been using wires as small as 19-gauge. I am highly pleased in seeing what the doctor has done. At the Toronto meeting the appliance he showed us was rather crude as compared with the one he uses today, and I believe the appliance he used at that time has been largely discarded by him.

Dr. L. S. Lourie.—I am particularly pleased with this presentation of Dr. Robinson's efforts for two reasons, one of which is that my first choice is always a lingual appliance where I can use one that is not too complicated and when it will do the work as well as a labial appliance. My reason is this: With a lingual appliance many times bands and ligatures can be dispensed with, whereas with the labial arch, bands and ligatures would be required to pull on the teeth instead of the pushing principle exerted as exemplified in the lingual arch.

Dr. Robinson has done a great service for orthodontia in emphasizing the point of using smaller and smaller gauge wires for moving teeth. In using small gauge spring wire on the lingual side he is able to use a smaller gauge wire with more safety than if

the same gauge were used labially, because he has a shorter length of wire and more perfect control over it.

Dr. Flint has pointed out that the smaller the gauge of the wire used and the longer the wire, the greater the danger in using it. I would also add, the more bends and modifications that are made in a wire, the more difficult it is to use.

In my paper which is to follow, I find it necessary to criticize Dr. Robinson's previous appliance along with the pin and tube and ribbon arches, because they work upon the same principle, that is, inconstancy of the appliance from the spring reaction. However, he avoided that criticism by discarding the other appliance and adopting this newer one. I believe the principle is very good, and is one that can be made use of if the proper care be exercised. To attempt to get an appliance which you can adjust and use for the average case and say that two or three adjustments will be all that is required, is misleading. It will do a great deal of harm.

I am glad to have heard Dr. Robinson, who has had experience with a wide variety of appliances, say that he has changed his ideas in that respect.

Dr. Manly Bowles, Winnipeg.—I had the pleasure a few days ago of being in Dr. Robinson's office. He showed me a patient he had in the chair and I can vouch for the condition of the teeth. While, as he said, the case was not completed, it was progressing very well. The teeth were moved bodily. I also saw the models where he had applied the tungsten wire. It is true he did not obtain ideal occlusion in one application, but I think that if every one had as good occlusion as was obtained by that one application, the members of this society would find little work to do. My own experience with Dr. Robinson's appliances has been very limited. In one case I had success, in another I did not.

Dr. Burt Abell, Toledo.—I would like to have Dr. Robinson explain to use if he finds any difficulty in expanding the molars at the end of this light wire. It seems to me, there should be some difficulty in doing that with this light wire.

Dr. C. A. Hawley, Washington, D. C.—There does not seem to be very much difference of opinion as to the value of lighter wire. The tendency seems to be all in that direction.

I was much interested in Dr. Robinson's paper at Toronto, and I have used one or two of his appliances. In his earlier appliance, the one he described formerly, I found the same difficulty that he and Dr. Lourie have mentioned. The attachments to be made to every tooth are all reactive forces. The advantage in the present appliance in the use of lighter wires, and the relief from bands, it seems to me, has not been sufficiently emphasized, it is an advantage from a hygienic standpoint. I do not think anybody will fit fixed bands to the anterior teeth and avoid all irritation. It is almost impossible to get correct hygienic conditions. The later evolution of the appliance presented by the essayist is a great relief from that condition. These lingual wires that can be removed and make possible ideal hygienic conditions in the mouth. If we can rotate teeth with a combination of labial and lingual wires without covering them with bands, there is a tremendous advantage, not only from a hygienic standpoint, but from an esthetic point of view. Neither the patient nor the operator likes bands on teeth, and in the last two years or more there have been tremendous strides made in orthodontia in that direction.

Dr. Ray D. Robinson, Los Angeles.—There is nothing further I have to say except to answer Dr. Abell. Why should there be any difficulty in expanding the molars? You can expand them where you will. Just as you widen your wire arch you can expand the molar or bicuspid region and expand it where you will.

Dr. Abell.—Is the force enough with that light arch?

Dr. Robinson.—Yes. There was over half an inch expansion in the molars and bicuspids, and there was plenty of force there. It is only a tiny bit of force that is constantly applied that will do it. If an appliance is put on today you can not expect results tomorrow or next week. If you use an appliance for a period of two or three months you will get results. It is like water wearing away stone, a little force will produce it. You can expand molars or bicuspids wherever you wish.

THE HISTORY OF ORTHODONTIA

(Continued from vol. iii, page 618.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

NORMAN WARREN KINGSLEY (1829-1913), the foremost of the early modern pioneers in our branch of dental science, described by one of our historians as "the father of orthodontia, author, artist, sculptor and inventor," began to publish occasional papers on regulating and palatal deformities as early as 1858. These practicable contributions became more numerous in the prime of his professional career, and through his individual influence, he succeeded to some extent in simplifying orthodontia.

Fig. 1.—Norman Warren Kingsley (1829-1913).

In December, 1879, he brought together the scattered knowledge of what is now our science, culminating his efforts in what was the first American treatise scientifically and comprehensively treated. His "Treatise on Oral Deformities as a Branch of Mechanical Surgery" was a standard textbook for many years and will always be considered a valuable contribution to orthodontia. It comprised, not only the results of his own labor, but summarized the efforts of those who preceded him, thereby stimulating to a greater degree the treatment of malocclusion of the teeth. The volume embraced seven chapters on irregularities of the teeth, their etiology, diagnosis, and treatment, besides a consideration of cleft palates and fractures of the mandible and their treatment.

Although Westcott and others had previously used the head cap for occipital anchorage, Kingsley, twenty years later, reintroduced this method, and for over forty years it proved the only successful method of handling extreme cases of malocclusion. The greatest credit is due him for being the first to successfully "jump the bite," as he proposed and executed the bodily movement of the mandible from a posterior position forward into normal occlusion with the maxillæ.

He also made use of the head cap to shorten teeth by retracting them within the jaw after they had elongated through "natural or developmental causes."

Kingsley greatly extended the usefulness of vulcanite, employing it in many ways and making it the basis of the greater part of his appliances. He also made use of the jackscrew, arch, elastic bands, and ligatures.

It will be impossible to review his articles as extensively as they should be, for time and space will not permit. His book is to be had and should be read carefully. It will not be possible to take up all his papers, only the most important being mentioned.

As the subject of etiology of irregularities has been brought together in his book, it will perhaps be best to review it there.

Irregularities of the Teeth (pages 1 to 25). "Irregularities, either in the form of the arch or the position of the teeth, are very uncommon in the deciduous set. We have seldom seen an irregular arch in a child prior to the eruption of the permanent teeth, unless associated with and correlated to some other deformity. In a few instances there has been observed a slight malposition of one or more of the incisors, sometimes of congenital origin, and sometimes the result of mischievous habits; as, for example, the two centrals may be pulled forward by the prolonged use of an artificial nipple, sucking the thumb or other similar habit.

"Congenital deformities rarely amount to more than a trifling displacement of one or two of the incisors; but, considering the temporary character of the deciduous teeth, and more especially the incisors, no irregularity in their position that we have seen can be regarded as of special importance, or as justifying any interference for its correction. They are to be classed as mere freaks of nature not associated with nor indicating any other peculiarity in the child. Nor do they prognosticate an irregularity in the development of the second set. This important fact can not be too prominently borne in mind. The deciduous dental arch is always well formed, and the positions of the teeth are regular (mere freaks of nature excepted). But from this perfectly symmetrical dental arch there develop with the growth of the permanent set some of the most astounding abnormalties.

"Symmetry and harmony do not imply uniformity; and the dental arch may be developed up to the highest type of perfection, and yet there exists as great a variety of form as there would be in the faces of the aggregated beauties of the world. Races, nations, and families are thus represented without deformity.

"In classifying the causes of irregularities, they will be placed under one of two heads—developmental or accidental; the developmental operating prior to the eruption of the crowns, and the accidental at the time of eruption or subsequently.

"The premature extraction theory rests upon the supposition that the jaw-bone contracts upon the removal of the deciduous teeth. The fact seems to have been entirely ignored that the teeth and alveolar processes are a superstructure of the jaw-bone, growing up on it, fulfilling their destiny, and passing away, without disturbing the foundation much more than an oak disturbs the planet upon which it has been sustained.

"Whatever may be the inducement to remove any or all of the deciduous teeth prior to their period of shedding, the canines should be retained until there is ample evidence of the early emergence of their permanent successors, unless the health or comfort of the child would be sacrificed in so doing.

"The question naturally arises, 'Is the presence of the deciduous teeth the cause or the effect of the irregularity?' If their presence be the cause of irregularities, then it is manifest that in this generation of malposed teeth it is our duty to anticipate the trouble, and at an early day remove them before even it is possible for them to give a wrong direction to their successors.

"Many of the forms of irregularity are directly traceable to inheritance, and are transmitted peculiarities. Probably in a large proportion of cases where the irregularity in a dental arch is confined to one or two teeth, the primary cause, so far as that individual is concerned, is a hereditary family peculiarity. The teeth of every person possess more or less individuality, and most of those peculiarities which stamp their individuality are inherited. The form and color of teeth, when not disturbed by abnormal influences, are derived from the same source. Whenever we find any departure from what we are apt to regard as the typal form of each tooth, or any disproportion of size in their relations to each other, we shall be likely to find them peculiarities of descent.

"There is one form of irregularity which is sometimes due to hereditary predisposition and sometimes to causes acting after eruption. An undue prominence of the upper incisors may be either congenital or acquired. The acquired origin is almost always a habit of thumb-sucking or its equivalent. It it not difficult, as a general thing, to make the distinction even without questioning the patient. In a protrusion of congenital origin the jaw is generally pinched in the bicuspid region, and the protrusion culminates in a pointed or V-shaped position of the central incisors. When such prominence has a mechanical or accidental origin, the whole front of the arch will be found rounded out, and the teeth pulled forward; and there will be likely to be more or less space between each of the teeth anterior to the biscuspids.

"A perfect dental development is the result of well-balanced physical and nervous systems, without hereditary taint.

"The causes of irregularities we classify as developmental and accidental; the developmental operating prior to the eruption of the teeth, and the accidental subsequently.

"Abnormalities of development having their origin in the same individual are due to a disturbance of the trigeminal nerve during the period in which the crowns of the permanent teeth are forming and arranging themselves in the jaw prior to eruption; or, when arising from causes antedating the life of the individual, are traceable to an inherited tendency, which tendency had its origin

in a like disturbance in one of the progenitors, and was subsequently transmitted; or are the result of mixing different and distinctly marked types of jaws and teeth by the progenitors.

"This proposition may be stated in another form as follows: The cause of irregularities of the teeth other than accidental lies in a want of development of the jaws commensurate with the size of the teeth; and this want of relation is sometimes due to a retarded growth of the jaw while the development and eruption of the teeth is not retarded, and sometimes due to the inheritance of large teeth out of all proportion to the size of the inherited jaw.

"In our view we do not call a feeble mind, a sluggish brain, or a dull intellect a nerve-lesion or a brain-disturbance; for it is abundantly proved that when this condition is associated with an average physique, the development of the dental organs is tardy, but in regular order.

"No force operating on the brain can interrupt or alter the type or inherited model of the dental arch, after the first decade of life. All cerebral disturbances occurring during that period, showing mental aberration, we should class under the head of idiocy—imbecility. After that period, such manifestations come more properly under the head of lunacy—insanity—which might degenerate into imbecility or idiocy. Consequently, neither lunacy nor insanity, in the ordinary acceptation of the terms, can have any direct bearing upon the development of the dental organs; but such a condition would be most potent of evil if transmitted to offspring.

"I do not hesitate to place it upon record that the next generation will see more of abnormality in dental development, and an increase of nervous and cerebral diseases, and that the two are correlated and spring from the same cause. It is too late to stop it in those who have passed infancy, but it is not too late to modify and partially remedy the evil in those now being born, and those who may be begotten hereafter.

"An erroneous teaching has maintained that the full number of teeth must be retained in the mouth, regardless of their organization, the progress of decay, the limited capacity of the arch, or the external features.

"Two arguments are advanced to support such a judgment: First, that a certain number of teeth are developed by nature, and therefore every one must be preserved. A second argument in favor of retention of all the natural teeth is, that the alveolar arch and the associated maxilla will become contracted, narrowed, pinched, as the result of such loss, consequently the articulation of the teeth broken up and the efficiency of the masticating organs impaired.

"The articulation of masticating organs is of much more importance than their number, and a limited number of grinding teeth fitting closely on occlusion will be of far greater benefit to the individual than a mouthful of teeth with the articulation disturbed.

"It is often better to extract a malposed tooth than disturb a whole arch to bring it into line.

"In hereditary cases of extensive character, which have been delayed until at or near maturity, we can never feel certain but that the original tendency to malposition, so long unbroken, will reassert itself at any time that we abandon retaining fixtures."

Treatment of Irregularities, published in *Dental Cosmos,* 1872, page 63:

"This treatment consisted entirely of wedges which were inserted between all the teeth, and worn from the first. These wedges were of elastic rubber, and used of such thickness only as would exert a gentle pressure. The retaining-plate answered a twofold purpose: it kept the teeth from the possible contingency of any one of them moving toward the center of the mouth; and secondly,—that which was of equal importance—points of the retaining plate were allowed to pass between all the teeth, which kept each wedge from slipping up into and irritating the gum.

"I have heretofore claimed something for esthetic art in the practice of dentistry; for the above I claim nothing but a recognition of pure mechanical principles in dental practice. The wedge is one of the recognized mechanical powers. Its application here is identical with its use by the architect for a keystone in building his arch. Drive in the keystone and the arch is necessarily enlarged, and will continue to be enlarged so long as a wider keystone is admissible, and there is a support which will prevent the whole arch from tumbling in ruin to the center.

"In a course of lectures delivered on this subject, I took the ground that everything relating to the means to be used in regulating teeth was purely mechanical, and the history of inventions has shown what marvelous works are accomplished by the most simple of mechanical contrivances. The foregoing case illustrates that the simplest of all mechanical powers wrought all that could have been done by jackscrews, levers, inclined planes, straps, bands, and pulleys, combined."

Under *Irregularities,* page 130 in *Johnston's Dental Miscellany,* 1874, Kingsley describes the following method of treating the "V-shaped maxilla."

"The treatment consisted of a plate of vulcanite adapted to the roof of the mouth. A hook of gold was inserted in the plate against each molar, and a little T-shaped catch was made of gold to pass between the centrals. Before introducing the plate, a rubber ring cut from tubing was secured to one of the hooks at the back of the plate, passed through a loop made in the stem of the T, and caught upon the hook on the opposite side. The plate was then adjusted to the roof of the mouth, and the T brought forward; its stem, being quite thin, was passed between the centrals, and the crossbar caught on their labial surfaces. This was the only treatment the case received, and in seven weeks the result was secured.

"The above case illustrates how great a work can be accomplished by a very simple means, and yet this kind of an appliance might not be of any benefit in any other case except one exactly like the above. This case would very naturally be termed one of a 'V-shaped maxilla'; but it was not a V-shaped maxilla.

"It was a V-shaped, or triangular, dental arch—an arch in which the sides from the base to the center were not curved as they should be, but nearly on a straight line. I believe therefore, that the apices of the roots were in the maxilla upon their normal line; the crowns of the incisors thrown beyond the line, and the side teeth drawn within it. Had it been otherwise I do not believe

that force alone, on the center, like pressure made on the keystone of an arch, would have produced the desired bulging at the sides.

"As to its cause, I have no knowledge sufficient to prove its hereditary character. I do not believe it to have been the result of 'thumb-sucking' nor 'fruitless sucking' of any kind. It was not associated with 'enlarged tonsils,' nor did the patient habitually keep the mouth open for breathing, and thus (as it has been claimed) have the sides of the arch unduly pressed upon."

On page 172 of the same publication in treating another "V-shaped maxilla" Kingsley states: "All of the teeth anterior to the molars are so related to each other that pressure on one point would cause the arch to collapse. Even if a plate had bridged the palate and come in contact with the teeth at the sides, so as to prevent a collapse, no force upon the center as they now stand would have carried those teeth outward. A fixture operating like the T would not have affected the bicuspids and molars, but would have drawn the middle incisors toward the center in the same twisted condition, and would have moved the laterals and canines irregularly apart.

"The widening of the arch, therefore, which is of primary importance, must be effected by other means.

"The correction of the deformity necessitated three separate stages and three distinct operations, as follows: first, the widening of the arch; second, the twisting of the central incisors, and third, the reduction of the V to a proper curve.

"The widening was produced by a jackscrew; that most effective of all known agencies wherever it is applicable.

"Its mode of adjustment is very fairly shown. A plate of vulcanite was made as there represented, so thin and elastic along the center that it would straighten under moderate force, and so stiff where it came in contact with the teeth that it would not yield. The attachment of the jackscrew is made after the vulcanite plate is finished, and is readily accomplished by carefully cutting a little mortise in the plate on one side and allowing the point of the screw to rest in a pit on the opposite side. This case was retained by a simple plate of vulcanite with a small gold wire embedded in it and passing to the outside of the six front teeth, through a small gap between the cusps of the canine and biscuspid on each side. If the articulation of the teeth of both jaws had been such, on occlusion, as to shut this gap, then this kind of retaining plate could not have been used." (Fig. 2.)

In February, 1875, in *Johnston's Dental Miscellany,* Kingsley illustrates his use of the head-cap to shorten the teeth by retracting them within the jaw after they had elongated through "natural or developmental causes." Perhaps the first effort to accomplish this movement of the teeth was that made by Kingsley in 1866, reported in the same year at the May meeting of the New York Dental Society and published in the *Dental Cosmos.*

Cases of Irregularity.—"In the child the incisors were protruding, and the whole upper jaw gave the appearance of being excessively large. The teeth of the lower jaw were normal.

"The teeth behind the canines were all in contact and articulated well

with those of the lower jaw, but the incisors were spread and straggled, and the crowns had the appearance of being of extraordinary length.

"As interference need be no longer postponed, I made a frame of gold, covering the cutting edges of the incisors, and lapping on to the canines, and a plate of vulcanite adapted to the roof of the mouth, such as described in former articles, and cut away in front to provide for the retrocession of those teeth. Ligatures cut from rubber tubing were attached to the posterior part of the vulcanite plate, one on each side, and drawn forward and caught on projecting spurs of the gold frame. This apparatus, which can be easily understood from the description, was worn for a short time, when two discoveries were made. First, the arch in front was by this means contracted, until the teeth came in contact, but was not sufficiently reduced. With the teeth all now in close contact, there was no hope of further reduction without the removal of a tooth, and the first bicuspid on each side was consequently extracted. Secondly, the backward movement showed an apparent elongation of the incisors. I do not think

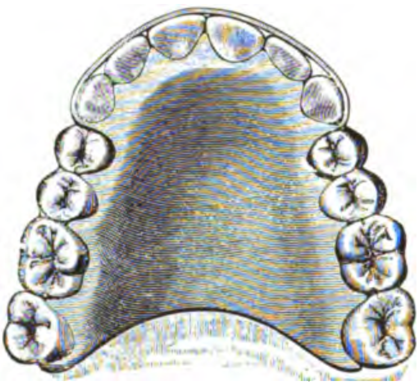

Fig. 2.

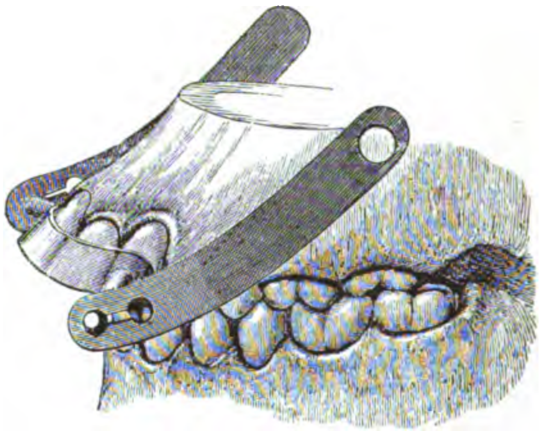

Fig. 3.

it was an actual elongation, but an appearance arising from crowns of an already extraordinary length becoming more perceptible as they came into a vertical line.

"It became evident that any further pressure in the same direction would eventually carry the teeth down so as to touch the gum of the lower jaw, thus completely hiding the lower incisors and producing a deformity but little preferable to the first.

"In this emergency I conceived the attempt to shorten the crowns of the upper teeth by driving them up into the jaw.

"I continued the apparatus as before described within the mouth, and added to the gold frame a stud or post about half an inch in length, soldered to it opposite the canines, and coming out of each corner of the mouth. This apparatus, when in position, is shown in Fig. 3. The arms extending upward, passing outside the cheeks, were made of strips of brass, and were connected by elastic ligatures with a skull-cap as shown in Fig. 4.

"This skull-cap was made of leather, and the whole apparatus was very easily applied as follows:

"The vulcanite plate was inserted in the mouth, and the rubber ligatures brought forward and caught as before described, the skull-cap placed on the head, and strong elastic straps were caught over buttons or hooks on the cap, and like buttons or hooks on the cheek arms. The action will be understood by observing Fig. 4. The outside pressure was forcing the teeth up into the jaw, while the pressure inside was carrying them in a direct line backward.

"The success in this case involved absorption of the walls of the socket, and is not to be confounded with some cases which I have seen since reported, where a tooth had become elongated by accident, as, for instance, the presence of a rubber ring around the neck of the tooth, and pressure was resorted to, to restore it."

On page 212 of the above mentioned publication of the same year, we find

Fig. 4.

the report of a case Kingsley presented before the New York Odontological Society. In this case he discovered that it was necessary, in order to reestablish normal occlusion, to bring about a new articulation.

"In all cases which I have heretofore observed of a well-shaped lower arch associated with a V-shaped upper one the articulation was not good, the lower bicuspids and molars articulated outside the cusps of their superior antagonists. I was puzzled over this anomalous state until my plaster models were made, and with a better opportunity of studying the articulation, I discovered that the lower teeth were articulating one tooth behind their normal place in the upper jaw, that is, the first bicuspid of the lower jaw was shutting between the bicuspids of the upper jaw, while in all cases the normal occlusion requires that the lower bicuspids should shut in advance of their correspondents above. In my plaster models I was able to see the perfection of articulation in this state of malocclusion, and also to see that the movement to shut the lower

jaw farther forward showed the upper jaw too narrow to receive it. It was thus that I obtained a clear insight into the cause of the deformity.

"The remedy evidently lay in the widening of the upper jaw until the lower would be received in its forward and natural place; and resolved itself, therefore, into three elements; viz., widening the upper arch so that the lower teeth could not articulate as they had been accustomed to; secondly, compelling a new articulation in an advanced position; and, thirdly, flattening the pointed and projecting appearance of the incisors."

Under *Regulating Teeth* in the January number of *Johnston's Dental Miscellany*, 1877, Kingsley described different applications of the jackscrew.

"Fig. 5 shows the employment of two screws upon the upper jaw. The

Fig. 5.

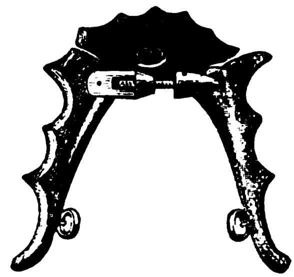

Fig. 6.

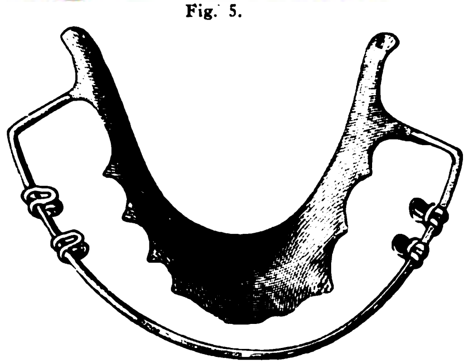

Fig. 7.

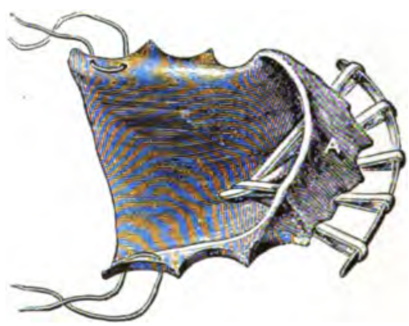

Fig. 8.

plate was of vulcanite, and the screws have no other nut than the plate itself. The plate was vulcanized around the screws, thus making the thread very perfect. This plate was used to drive out a very stubborn canine, and also to twist a central incisor.

"Fig. 6. is an illustration of the same principle applied to both sides of the lower jaw, and was used in a case where the inferior dental arch was narrowed and the canines pushed outside the line. Elastic straps were attached to the extremities of the plate, as seen in the engraving, and drawn forward over the canines, which came into line as soon as the arch was widened. The spreading of the lower jaw is ordinarily much more difficult than the upper, and such appliances as Fig. 6 possess peculiar advantages in utilizing the extraordinary power of the screw, when the presence of the tongue would make a screw bearing directly on the teeth inadmissible.

"The following engravings will illustrate some of the appliances of elasticity.

"Fig. 7 shows a combination of vulcanite and gold wire for bringing into line certain irregular teeth upon the lower jaw.

"It was a former practice in a case like this to use the wire band independent of the plate, the ends being tied with silk or twine ligatures to the molar or biscuspid teeth; but experience showed that the ligatures were apt to irritate the gums, besides giving much trouble whenever the fixture was removed for cleaning by the difficulty of retying. Consequently, the wire was carried over the teeth, selecting such a gap when the jaws were closed as was most favorable, and the ends of the wire anchored in vulcanite. In this way perfect facility in removing and replacing was obtained.

"Another advantage derived from fixing the wire in a vulcanite frame is the steadiness with which the wire is kept in relation to the teeth.

"In drawing teeth toward a wire, rubber elastics exert a constant tendency to force the wire into some position where the elastics will not remain on the teeth, particularly the incisors and canines."

Treatment of Irregularities with Inclined Planes and Levers, in April, 1877, issue of *Johnston's Dental Miscellany,* page 121:

"Fig. 8 shows another application of an inclined plane somewhat out of the ordinary course.

"It was adapted to the inside of the superior dental arch, and the inclined surface marked *A* projected below and caught the inferior incisors.

"The object was, not to protrude the lower teeth, but to change or jump the bite in the case of an excessively retreating lower jaw.

"In the engraving the appliance is shown bottom up, to exhibit more clearly the attachment of some elastic ligatures which were caught on a hook in the roof of the plate, and were drawn out through corresponding openings, and connected with a gold bar worn across the front of the superior incisors to reduce their prominence.

"The fixture was worn constantly, and in a few months produced the desired result. The objection urged against the use of an incline, because the time required had a tendency to alter the articulation of the teeth, was in this case an argument in its favor, and an advantage, because a new articulation was desired, and the incline, as adapted, offered no opposition to the antagonism of the teeth.

"The principle of the inclined plane is always operating in the mouth, and may often be taken advantage of beneficially, while at other times it will tax our ingenuity to the utmost to overcome its powerful influence. In the case of the superior incisors shutting within the lower, after they have been brought forward so as to barely catch over the lower ones, then the principle of the inclined plane becomes available in completing the operation.

"The points of the lower teeth, catching within the upper ones, strike their natural inclined surfaces, and nature may be relied upon for the rest.

"In moving the bicuspid teeth of the upper jaw, either outward or backward, all that is accomplished by fixtures may be entirely overcome by the articulation of the lower teeth forming an inclined plane, and thus acting upon the upper ones to return them to their former places.

"Levers do not come into such universal application as do some other powers; the principal objection being, that the limited space of the mouth does not permit their unrestricted movement.

"Levers may be used to advantage in revolving teeth in their sockets; and for this purpose a band around the tooth is necessary, which will not slip, and the lever will be attached to the band. Force may be brought against the long arm of the lever by ligatures connected with convenient teeth. Such an appliance will pretty surely accomplish the result, but it can generally be obtained with a less cumbrous fixture.

"Levers may often be advantageously used on the outside of the arch, to press gently against some offending tooth, and thus drive it into its desired position.

"One figure illustrates a method of reducing one or more teeth to a regular line by means of a wire or bow going around the outside and acting partly as a lever and partly by the force of elasticity. The engraving sufficiently explains the action. The plate is of vulcanite and an elastic loop acts to contract the circle by drawing the ends of the wire together.

"There was a wide gap between the lateral incisor and the canine tooth, and the opening extended through the alveolar arch and into the nasal passage.

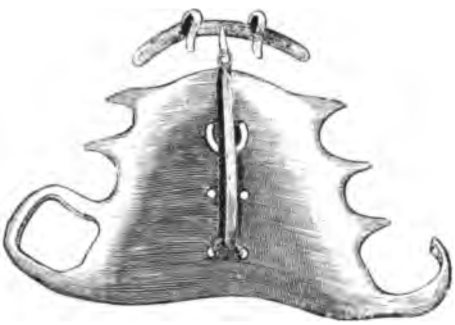

Fig. 9.

"It was desired to bring the maxilla into contact, and a fixture like the last would only act upon the teeth, tending to give them a wrong inclination." "This fixture was made to embrace the gum as well as the teeth with the wire running through the length of the vulcanite to give both stability, and the terminal hooks were drawn toward each other when *in situ,* with a silver wire wound around and twisted with a pair of pliers. In the process of twisting, the gap was seen to perceptibly close, and ultimately came together and united."

Before the New York Odontological Society, February 18, 1879, Kingsley introduced a new and novel method of regulating teeth. This method is described in the *Dental Cosmos,* page 323, of that year.

"A new vulcanite plate, adapted as a retaining plate to the widened arch, was introduced, and this became the anchorage of another rubber strap, to which was attached, for greater convenience, a little gold crossbar for the incisors with a little stem and an eyelet, passing between the teeth, as shown in Fig. 9. The stem was long enough to rest its end upon the vulcanite, and thus keep off pressure from the gums. To keep the crossbar from slipping up into

the gum, a little hook came down over the cutting edge of each central, and thus completed the appliance for regulating, save that as the centrals became flattened the crossbar was lengthened to bear on the laterals, and at a later period and for a short time only included the canines. The horseshoe-shaped opening seen in the plate, Fig. 9 was made as a ready means of attaching the rubber ligature, but in consequence of the lengthening of the stem of the brace the ligature was afterwards fastened farther back, as seen in the engraving. In just five weeks from the day when the operation was commenced, the process was completed.

"I desire to call your attention especially to the simplicity of this whole apparatus.

"One or two vulcanite plates so devoid of intricacy that any one could make and adjust them; and although the crossbar and stem may seem a little more complicated, they are really not essential to success. By pulling the rubber forward and tying it to a bit of broken match, the same flattening of the centrals would result."

In the thirty-fourth volume of the *Dental Cosmos,* 1892, pages 16, 100, 357, 442, we find undoubtedly the most important series and contributions that Kingsley gave to orthodontia. Although entitled *Adenoid Growths, Mouth-Breathing and Thumb-Sucking in Their Relation to Deformities of the Jaws and Irregular Teeth,* he describes, for the first time, "jumping the bite," unquestionably one of the greatest adjuncts we have in our treatment of orthodontic cases. The case described is one of the open-bite types.

"The opening of the jaws in front was due slightly to the projection of the incisors, but principally to an excessive and abnormal development of the alveolar process in the molar and bicuspid region, and the remedy must be in its reduction; or, in other words, the teeth and processes must be driven higher up.

"The pitch and projection of the upper incisors would have been heretofore attributed to thumb-sucking or its equivalent, but that practice had never been acquired; the child had never been a thumb-sucker. Still we find typical thumb-sucking case where there had been no thumb-sucking,—a perfectly developed and symmetrical lower jaw and a strangely abnormal upper one, coincident with adenoid growths of the pharynx and long-continued mouth-breathing.

"It will be observed that the upper jaw is also normal in width and outline, and the back teeth of the upper jaw occlude or articulate properly with the lower ones; the opening of the mouth has not, therefore, caused a pressure of the muscles of the cheeks upon those teeth and narrowed the jaw.

"As a proper correction of this deformity required the incisors to be carried backward somewhat, and as there appeared to be no spaces in the arch which would permit of its contraction, the first or sixth-year molar on each side was extracted."

Up to this time Kingsley believed it was necessary to extract teeth to correct irregularities of the teeth, but after completing the case recorded he in his own words proves the fallacy of this procedure. "I am convinced by a study of the case since the correction was completed, that the extraction of those permanent teeth was unnecessary. I find now, to my surprise, that although there

then appeared no room to carry the incisors back without extracting two teeth, there are now ample spaces among the teeth on each side to permit of another tooth.

"The first attempt at correction was made with a skeleton skullcap, as seen in Fig. 10, a padded cap over the chin (shown in Fig. 11) and a frame over the incisors, with arms projecting outside the cheeks, as shown in Fig. 12. The

Fig. 10.

Fig. 11.

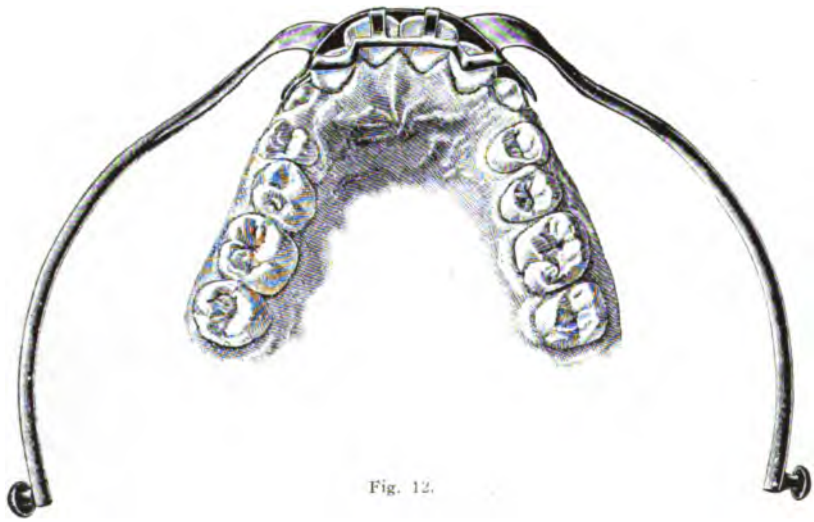

Fig. 12.

skullcap was made of leather; the chin-cap of sheet copper (stiffened around the edge with nonelastic steel wire accurately fitted to a plaster cast of the chin) padded, and covered with leather. When these appliances were in use, an elastic strap cut from rubber tubing passed from the hook near the angle of the chin-cap to the hook marked *A* on the skullcap (Fig. 10) and another similar strap passed from the button at the end of the incisor frame to the hook marked *B* in Fig. 10. The expectations from such an arrangement are obvious. The strain

upon the incisors would carry them directly backward, and the hope was entertained that the pressure of the lower jaw upon the upper at the points of contact would diminish the undue prominence.

"It is worth while here to query whether pressure, being equal upon the lower as well as the upper molars, might not, if it had ever accomplished anything, have done so at the expense of one jaw as much as the other. However that might have been, the fact was that although worn constantly night and day, except at meals, for about three weeks, the chin became so sore under the pressure that we feared an abscess, and it was abandoned. It is doubtful if it served any purpose in closing the gap in front.

"The frame upon the incisors did accomplish in that time all that was desired of it. The incisors, without being lengthened, were altered in their pitch and the cutting edges moved back.

"The reason that this apparatus did not lengthen the incisors in their backward movement was because the strain put upon the crowns was not at a right angle with a line lengthwise through the center of the tooth. The strain was

Fig. 13.

at such an angle that the teeth were held in their sockets by a partially upward pressure while the absorption of the process behind them was going on. The distance backward which the cutting edges were carried was ascertained to be eleven per cent.

"The second apparatus, which fully accomplished the work, I ought to have thought of in the beginning, as it is only an application of the principle involved in my interdental splints for the last twenty-five years. It is shown in Fig. 13. A frame covering the bicuspids and molars of the upper jaw, with arms coming out of the corners of the mouth and extending along the cheeks to a point exactly opposite the center of pressure required within the mouth; a small wire passed in front of the incisors to keep them from springing forward, and two elastic straps connected this frame with the skullcap exactly as seen in Fig. 10. Both these elastics were required partly to prevent any tendency of the recently moved incisors from carrying the whole apparatus forward, but particularly to keep the proper balance of the skullcap, the strain of either elastic alone having a tendency to pull it out of place.

"The apparatus is made of one continuous piece of Stubbs' steel forged to follow the buccal faces of the teeth, then pass through the gap made by the extraction of the molars, and cross (without touching it) the vault of the palate to the other side. The bearings upon the teeth were made of silver plate swaged with accuracy to fit the molars, to keep the frame from slipping about, but resting only on the cusps of the bicuspids, thus giving freedom for lateral movement of the bicuspids.

"It was essential that the extremities of these arms should be adjusted with great nicety, so that the force exerted through them upon the offending teeth should be evenly distributed. If the bearing were forward of the center, the apparatus would be loose at the back, and vice versa. This apparatus was applied about the first of March, 1891, and worn almost uninterruptedly without inconvenience until June following, at which time the upper and lower incisors were in contact, the upper ones lapping normally.

"A study of the models shows that the articulation of the molars at the present time is precisely the same as before regulation commenced, and the great

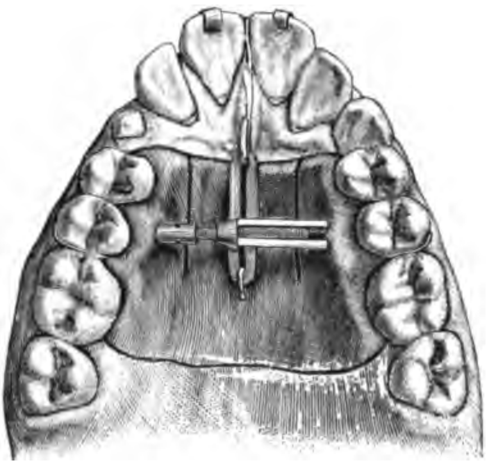

Fig. 14.

change in the front of the mouth is attributable principally to the driving upward of teeth in the molar region the upward and forward movement of the lower jaw, and partly by the incisors being carried back without elongating.

"The plan which I formed to correct this deformity was the result partly of my own judgment, and partly to humor the strong desire of the mother that it should be done, if possible, without extracting any teeth. With that view I decided to attempt to accomplish it by widening the jaw, retreating somewhat the upper incisors, and complete it by 'jumping the bite.'

"The apparatus for that purpose is shown in Fig. 14 and consists of a vulcanite plate and jackscrew for widening the arch, and, acting simultaneously with it, a T-bearing on the face of the central incisors and connected by a rubber strap to a hook in the central part of the plate, as seen in Fig. 14.

"The jackscrew was tightened daily for a couple of weeks, and the jaw

widened about half the diameter of a bicuspid, but the incisors had not moved perceptibly, nor had the widening made an enlargement of the circle sufficient to permit the incisors to be carried back.

"A plate was made of silver covering the roof of the mouth and the teeth. This was made of silver in preference to vulcanite because I wanted as little thickness as possible over the molars and bicuspids, and that thickness to be uniform, so that the interference with the lower teeth in mastication caused by widening the upper jaw might have a tendency to widen the lower one to the same extent. This plate was retained in position by narrow clasps around the molars, and, when fitted, a bite was taken upon it in wax to show the position of the lower incisors.

"The plate was then extended horizontally like a flange or apron in front

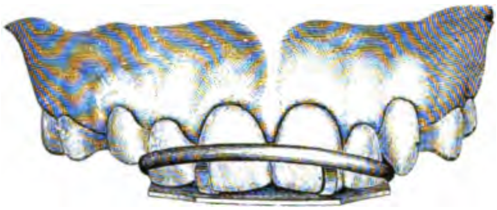

Fig. 15.

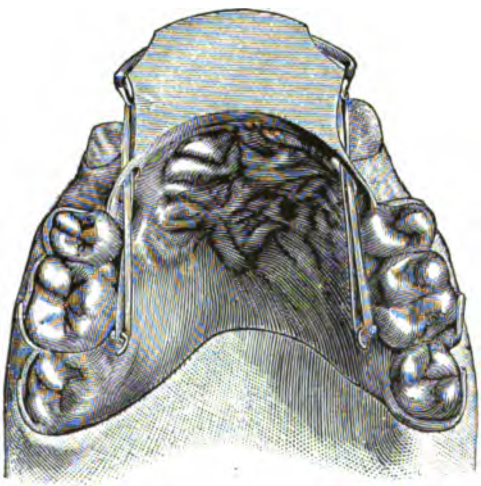

Fig. 16.

of the lower incisors, on a level with and resting upon the cutting edges of the upper incisors. This apron did not interfere with the lower incisors in masticating, as they closed behind it.

"A stout band of gold was made to fit the face of the upper incisors, with a hook at each end, and hooks over the cutting edges to keep it in position. The strain upon the teeth was made with rubber elastics reaching from the extremities of the bar backward, and caught on hooks near the posterior border of the silver plate. This apparatus is shown in Figs. 15 and 16. It needs no argument or description to show that while in use the incisors must be moved backward by the strain of the elastics, and that it was impossible for them to become

elongated so long as the plate was kept in close contact with the molars and bicuspids and this contact was secured by the clasps and by mastication upon it. This is exactly what it did accomplish. It was worn uninterruptedly except for cleansing, and was readily removable (almost too readily) by the patient. The only attention required at the office was to cut off the horizontal flange from time to time as the incisors were retreated.

"An appliance as shown in Fig. 17 was adjusted. It was a vulcanite plate with piano wires, one from each side, meeting and lapping in front, and in their relaxed position standing off for an eighth of an inch from the face of the teeth, but were sprung in and tied to the incisors with waxed ligatures. This vulcanite plate was made pretty stout, comparatively nonelastic, and impinged upon the lingual walls of the bicuspids and molars, for the purpose of assisting nature, which was widening the arch by occlusion with the upper one, and, as from time to time it loosened by those teeth yielding, the plate was warmed and readjusted. A small ring from rubber tubing was also stretched over the three teeth, to assist in closing the gap.

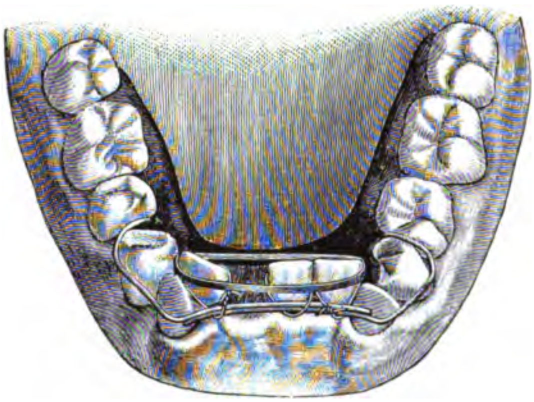

Fig. 17.

"The most singular result of the rearrangement of the lower incisors, and one for which at present I do not attempt to account, is that these teeth have gone down into their sockets not less than a quarter the length of their crowns; they are no longer higher than the natural plane of the lower arch.

"I say that these teeth appear to have been driven into their sockets, but no apparatus worn on either the upper or lower jaw could have had such a tendency; on the contrary, the strain upon them in moving forward would have been more likely to have elongated them than to have shortened them. If we can not accept the idea that they sunk in their sockets, we are forced to the only other alternative, that all the other teeth, cuspids, bicuspids, and molars, simultaneously and uniformly rose from their sockets, for certainty now the plane is not abnormal."

Another appliance similar to Fig. 16 was devised to correct another case and is shown in Fig. 18. Figs. 19 and 20 are the means used to jump the bite.

"The appliance for the mouth, Fig. 20, was a copy of the silver plate already worn, also made of silver, with the addition of arms attached to it pro-

jecting from the corners of the mouth and extending along the face a couple of inches toward the ears. A skeleton skullcap was also made, and connected with the arms by an elastic strap, as seen in Fig. 21. This, as will be seen, was thus acting only upon the upper jaw, and was not originally intended to reduce that undue prominence, nevertheless it did prove of great value in that direction.

"The primary object of this skullcap and its connections with the plate in the mouth was to afford an attachment for an elastic band going under the chin, which should press with only sufficient force to overcome the natural inclination of the lower jaw to drop."

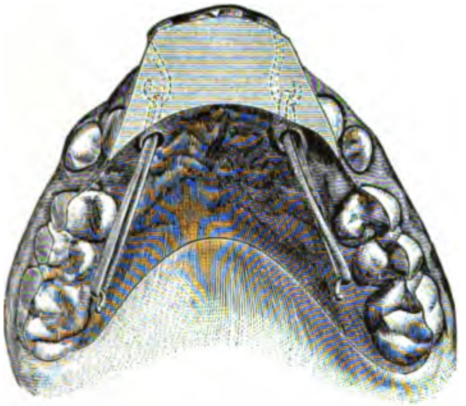

Fig. 18.

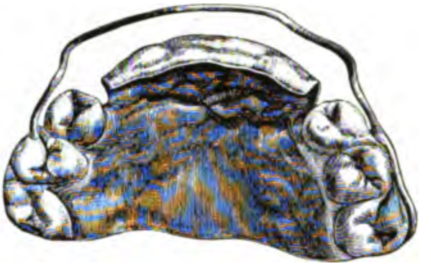

Fig. 19.

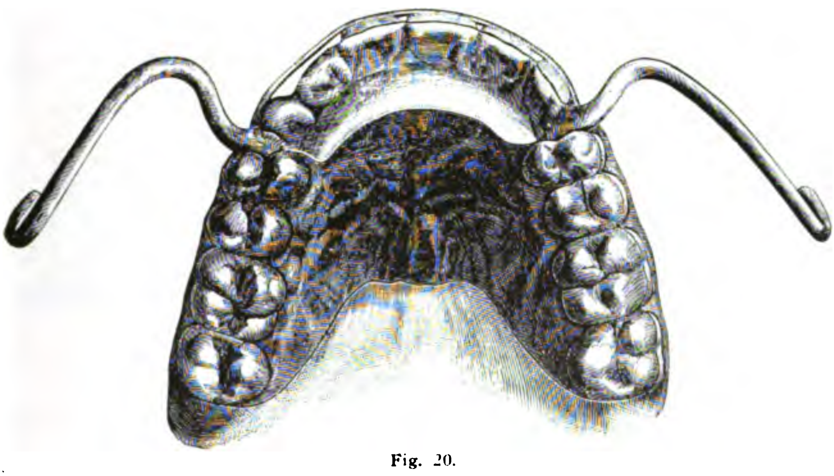

Fig. 20.

In concluding this series of articles Kingsley says: "A moment's reflection will recall the knowledge to any dentist that the lower jaw can be moved forward or backward on the same plane, more than the diameter of a tooth, and this difficulty confronts everyone in making full sets of artificial teeth."

Fifty years after his first article appeared, in a journal we find what was undoubtedly the last Kingsley gave to orthodontia. In a letter to the Alumni Society of the Angle School of Orthodontia, published in the *American Orthodontist,* page 125, he states:

"Gentlemen, Students in the Science of Orthodontia and Fellow-workers in the Art:

"I greet you as colleagues in one of the most interesting and important specialties of medicine.

"If half a century of continued efforts to improve the art entitles one to be called a patriarch, I certainly am a patriarch.

"Some one has said that I am the 'Father of Orthodontia.' I make no claim to that honorable distinction, but for the purpose of this letter I accept the designation and will endeavor to act the part of the counsellor to his disciples.

"This is not a formal address, it rather a 'heart to heart' talk of a father

Fig. 21.

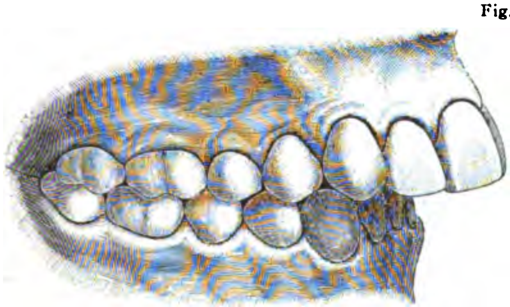

Fig. 22.—The occlusion of the teeth prior to "jumping the bite."

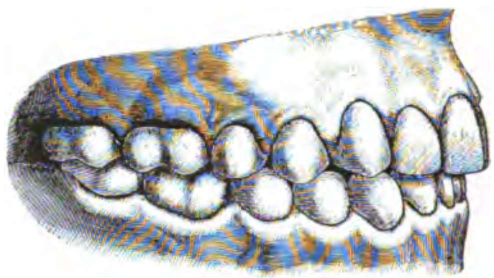

Fig. 23.—The final occlusion of the teeth.

to his sons, who are at the threshold of their careers, for whatever age you may be individually, you are still beginners.

"You are the Alpha, I am the Omega.

"What I may say is not likely to be new to you; at most I can only refresh your minds upon things you have already learned—much may appear common-place and obvious and will command your respect only because common-places when hoary with age are frequently counted as wisdom.

"Fifty years ago there were no orthodontists. There was no orthodontia. We were not practicing a science, we were just straightening crooked teeth and making them even in the arch. We had no settled system and therefore it was not entitled to the distinction of a science. It may be that the term had been

coined before that time, but if so, it was not in common use and indeed now it is not to be found in some of the most modern dictionaries.

"We were empirics—experimenting, inventing and trying out our plans. All science begins in empiricism and orthodontia as a science was founded in empiricism. I think your Dr. Angle has been one of the greatest empirics of his day—mind you, not a charlatan, but an experimenter, and out of his empirics he has forged a system of related facts, and thus his empiricism has contributed to create a science.

"There could have been no greater empiric for thirty years or more than I, myself, for during all that time I was constantly regulating teeth and without any previous experience of others or any knowledge except that gained by experience. I was devising new ways to meet every emergency.

"You young gentlemen have a great advantage. Your brains are not taxed by conceiving new experiments and trying plans that end in failure. You have a formulated science and proved system to guide you in almost any conceivable emergency. I congratulate you—you start your careers without the handicap of ignorance, and wonderful possibilities lie before you.

"I want to impress upon you a few things as a father out of a father's experience. Start fair—begin right—don't take a second step until you are perfectly sure that your first is correct. Study your case from models as well as the oral cavity, but be sure that you have perfect models. Be sure of a good impression—no matter what material you use. Do not be guilty of the solecism of showing an imperfect cast and apologizing for it by saying that the impression was taken in a hurry. Be honest and own up that it was the best you could do.

"Of all things, this step must not be hurried. Better none at all than a hurried, defective one. If your time will not permit, then postpone the setting. Don't begin this most wonderful branch of technical scientific art with a false start. Let exactness be your dominating motive—exact in every step and each succeeding one will be attained easier and the end a triumphant success. Except in the very simplest cases, make and keep good models of your cases properly occluded and articulated. It is better that you connect your casts at the heel either by a hinge or guide-pins and thus preserve the occlusion from being bruised by handling.

"Preserve with care for study and future reference the first casting from your impressions and be particular about the appearance of these models. Appearances go a long way to support assumptions. I think in times past my colleagues have been more impressed by the symmetry of my models than by all my talk. Talk is cheap—anybody can talk, but it is not everybody who shows neat, carefully prepared, artistic models.

"Fine models, without any talk, carry more conviction than all the oratory with a display of unsightly plaster casts. Many times I have seen an exhibit of dirty casts, apparently rescued from the ash-heap, which challenged attention only by their number and shabbiness—casts exhibited to illustrate some phase of orthodontia, devoid of articulation, only as held in the hands. Casts that so far as accuracy went, might have been mismatched and almost reversible. A lot of teetering, wabbling models with the cusps rubbed off to such an extent

that one could prove almost anything by them. Such models prejudice the standing of orthodontia more than they advance it, while on the other hand, beautiful models not only command the respect of your colleagues, but are an ethical form of advertising to your patients both justifiable and commendable.

"It it not so difficult to straighten crooked teeth. The requirements for bringing into proper relations and alignment have been in a great measure anticipated and appliances have been developed until a system of general application is at your command. In the present advanced state of mechanical apparatus, it is not a difficult matter to get the dental system into a position acceptable to your patients and yourself, but to hold it there until it becomes permanently settled is a much more serious problem. It is the *one important consideration* in all your prognosis. *The success of orthodontia as a science and an art now lies in the retainer.* The perversity and contrariness of inanimate things is proverbial and nowhere more strikingly exhibited than in the effort of nature, when forcibly diverted, to return to its former condition. Again, what we call nature, seems frequently more disposed to go awry than right and here nature is seconded by the impatience of the subject, who, having gone through a period of prolonged strain, encouraged by the progress and by the expectation of benefit and satisfied with the accomplishment, feels any continuance is a hardship. Too often has the victim been left in a worse state than before the beginning; gains have not been fixed, the work must be renewed and between the see-sawing of advance and retreat a nervous system is shattered which will take a life-time to recover.

"The ideal, universal retainer has not yet been devised. I warn you, therefore, with all the solemnity of a patriarchal experience, do not discharge the case or abandon retainers until there is reasonable expectation of permanence. You may rightfully ask of that experience, 'How long will that be?' Your patient will pester you with the same query. Out of the same observation and experience, I can only answer—I am agnostic, I don't know. In each and every individual case, I don't know. It took a long time to go wrong, it will have to be held a long time to overcome the tendency to retreat and particularly if the malposition seems to come from an inherited tendency, not a settled inherited deformity, but a predisposition which can be obliterated by correction and its transmission aborted. Settled transmitted deformities become permanent types.

"I want you to realize that in adopting this specialty you must be something more than a mere mechanic. One who, like the plumber, has been taught his trade and can do only those things that he has learned and do them in no other way. You must become an artisan and apply brains to your mechanics, but more than that, if you meet all the possibilities of benefit to your clients, you will encroach upon the domain of the artist, which involves the highest order of mechanical achievement. This is an extravagant Utopian claim or expectation. The altruist can reach no higher ideal than you in fulfilling the requirements of your vocation. You not only make your patient physically better, but you contribute to his self-respect and to his beauty. Within limits, you can transform a face

from inharmony of feature to symmetry, from ugliness to comeliness, and from a repulsive expression to a winning one.

"A few years ago a gentleman whom I regard to be the most distinguished representative of intellect and culture that America has ever produced, a veritable giant in attainments, said to me: 'I want to thank you for what you have done for my son. You have transformed him with an ugly face and made a right handsome boy of him.'

"In the effort to become artists in orthodontia as well as artisans, do not let sneers or ridicule affect you. Forty years ago I was lecturing to a class upon these general lines when I encountered in print, from the pen of a dental editor, who was likewise a college professor—referring to my lectures, he wrote: 'Whose art is some plaster casts and his lectures maudlin sentiment.' Was it maudlin sentiment? Forty years have passed, but I may be permitted to say that the name even of that professor is forgotten while the 'maudlin sentiment' has become a part of the advanced teaching of orthodontia.

"Bear in mind that you are engaged in a profession, not in a trade. The education, culture and customs of civilization all accord superiority to the learned professions and require that they be conducted with dignity and in a manner to avoid reproach. There is an unwritten code of ethics among honorable men which you will not violate, but while your vocation is beneficent and humanitarian in a large sense, it is also a business and must be so conducted as to bring a remuneration equal to a similar education and ability in other occupations in your environment. You are entitled to fees that will maintain your social standing with the better class of your neighbors. You must get these fees by your recognized skill. You must obtain patients on your merits and not under any circumstances by offering or paying commissions to any one whatsoever. Commissions offered to a professional brother mean bribery, detested by all honorable men. Commissions exacted are equivalent to the demand of the road agent of the plains—'stand and deliver.' Commissions paid by you mean cowardice. You yield to a 'blackmailer' under the threat of injury. You yield to the demand from your professional brotherhood under the implied threat of a loss of bread and butter. It is nobler to go hungry than buy bread at the sacrifice of professional dignity and honor.

"In all my fifty years of experience I never offered or paid a commission to any man and I was constantly receiving patients recommended to me by dentists. If your fellow-practitioner can not treat the case properly and feels that he can not afford to let it go without remuneration, find some other way of recompensing him than by vulgar coin. Send him some patient that his ability can master and thus establish reciprocity. I believe in reciprocity. Let him have all the fee without rebate that the patient is willing to pay. Let it be a matter entirely between themselves. This does not refer to business arrangements that you legitimately make with an associate or an assistant upon a division of the fees, for in the latter case he becomes, in the eye of the law, a partner; the arrangement is a legal co-partnership and will stand the test of the courts.

"You are filling a most important place in the world's work. You are making people more comfortable and incidentally improving the race. In the

very best sense you are a humanitarian and an altruist. It is right that on all proper occasions you magnify your vocation, but don't get bumptious or conceited. Your calling is exceedingly limited in its influence on mankind as contrasted with men of large affairs. The captain of industry is master and director of enterprises that benefit the masses and contribute to the progress of civilization. Yours is limited to the invididual, therefore put forth your claims to recognition with becoming modesty and thus command respect for yourself and for your science.

Lives of great men all remind us,
We can make our lives sublime,
And departing leave behind us,
Footprints on the sand of time.

"Warren Point, New Jersey, December 3, 1908."

Isaac Woolworth in the *Dental Cosmos,* November, 1865, page 189, under *Treatment of a Case of Irregularity of Teeth* says: "I took an impression of the entire jaw and teeth, as far back and including the six-year-old molars, and made a plate or cap of hard rubber over all the teeth, not, however, covering the palate to a very great extent. I placed a quantity of plaster on the cast in front of the deflected teeth, so that the plate would arch out at those points, and filed the plate so as to expose the cutting edges of these teeth about half their height. I then drilled two holes opposite each tooth I wished to move, tied some strings of strong cotton thread around each, and passed the ends through the holes and tied them fast. I renewed the strings daily for four weeks, and dismissed the case perfectly corrected, with instruction to wear the apparatus in the same manner, except in tightness, four weeks and longer, if the teeth inclined to fall back. The advantages of this fixture are in its simplicity, the ease in which it is worn, the constancy and uniformity of the tension, the certainty of keeping the jaws asunder so as to insure the transit of the deflected tooth over the under tooth, the ease with which it is adjusted from day to day, and it causes no soreness to the gums."

Thomas C. Vidler in the *Dental Review,* April, 1864, on *Treatment of Irregularity of the Teeth—A Case in Practice,* says:

"I commenced operations on the lower jaw by moving the lower front teeth outwards, employing for that purpose, a plate of vulcanite, into which was inserted pegs of compressed hickory wood, so arranged behind the teeth that the pressure of the wood moved them forward in the required direction. Attention was given at least twice a week to the progress of the case, and at the end of a month's time a considerable improvement had taken place, and a second plate became necessary. This was adapted in like manner as before, and in another month I had accomplished all I desired with the lower teeth.

"A thick vulcanite plate was constructed to fit close behind the teeth. Pressure was first applied by means of compressed wood to the lateral incisors and canines, and subsequently to the bicuspids. At the same time the position of the front lower teeth was considerably improved by the force exerted upon them by the great thickness of the plate behind the teeth, which, forming an

inclined plane, continued to press them forward in the required directions. This appliance was so far found to answer the purpose, that it was worn without discomfort, and retained in position without inconvenience. The wedges of compressed wood were regularly changed every second day for a period extending over several weeks, and subsequently about every third day. Three plates were required for the upper, before the teeth were brought into position."

T. Burgh in the *Dental Cosmos* under the *Transactions of the Brooklyn Dental Association,* January, 1867, page 420, introduced the subject of the evening, *Regulating Teeth;* explaining his method as follows:

"The object was not only to regulate these teeth, but to expand the roof of the mouth and increase the size of the arch, and without extracting any teeth. The method employed is as follows:

"A cast is obtained from a wax impression. The teeth and the surfaces of the roof of the mouth to be acted upon are cut or scraped away to an extent equal to the amount of space which it is prudent to move the teeth at one time. The plate is then inserted in the mouth, the patient is directed to exert force upon it with the lower teeth, which forces it up into the roof of the mouth—expanding the arch in whatever direction the force is applied. In this case every tooth was operated upon at the same time—some more and others less—and also the roof of the mouth in every direction except upward. As soon as the teeth have yielded, the plate will begin to operate in the roof of the mouth. It will operate here more slowly, as the force has to reach the maxillary bones through the yielding gum. The gums will sometimes become inflamed, but if the cast has not been cut too much, this will pass away as the bones expand. Care should be taken to have the plate antagonize with the lower teeth, so as to produce a uniform and steady pressure. It is not well to cut the cast much, in order to get more work out of each plate, for the plate will not work as well as though the cast were cut moderately. He generally cut his casts the thirty-second or the sixteenth part of an inch.

"As soon as one plate has done its work, a new impression should be taken, and the process repeated.

"After the arch had been expanded considerably, he commenced to turn the three incisors. This is done on the same principle as that on which the arch is expanded; viz., by cutting away the plaster teeth in such a way so that a rubber plate made to the cast will produce a twisting pressure on the natural teeth. The same kind of plate is used for this as for the former, but with the difference that the plate runs over the cutting edges to be acted upon, and on to whatever portion of their labial surface is to receive a pressure. Before making the plate, an amount of plaster is moulded on to that surface of the tooth which is opposite to that which has been cut, to leave room in the plate for the tooth to move."

E. A. Bogue, in the same journal described the following method:

"A gold plate covering the roof the mouth, attached to the molars; from the clasp, between the first molar and the bicuspid, a thick bar ran outwards three-sixteenths of an inch. A piece of clasp metal was bent to fit around the

circle of the upper teeth, reaching from the space between the bicuspids on the one side to the same point on the other; the two ends of this band were bent outward at right angles with itself; in front, opposite the incisors, some small strips were soldered and bent into hooks over the cutting edges of the incisors, to prevent the band from slipping up against the gums. Holes being now drilled through the two outward bent ends of the band, and also through the two projecting studs in front of the molars, and screw threads being cut in the latter, it only remained to insert screws in their proper places to complete the apparatus. A few turns of the screws each day sufficed in a few weeks to draw the teeth inward to such an extent, that from a picture sent him some time afterward he should not have known of the previous deformity."

A BAND RING

By Carl O. Engstrom, D.D.S., Sacramento, Calif.

A SIMPLE band ring with a wide range of usefulness in orthodontic treatment is herein illustrated and described. By the proper application of ligatures and an arch wire it is possible to move teeth in any direction or a combination of the same, so it is with the band ring which is often advantageous. The means employed is always a matter of knowledge, judgment, and skill on the part of the operator. This ring differs from the ordinary ring with its one-point attachment to the band in that a more secure attachment is provided with

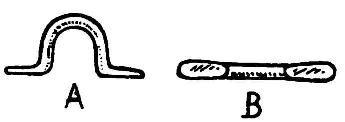

Fig. 1.

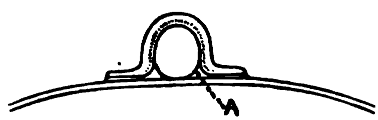

Fig. 2.

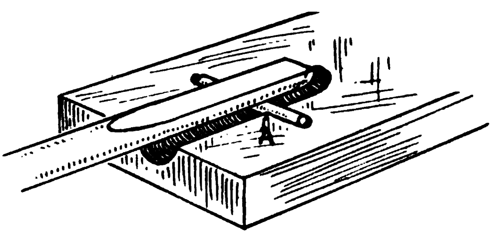

Fig. 3.

a minimum amount of material and a more efficient application in use is afforded.

In Fig. 1 is shown a small piece of wire used in the making of the ring. The flattened ends allow for the wire being easily positioned on the band and gives a sufficient surface for attachment in soldering. It will be observed that the wire is of such form that it can be held with pliers. Fig. 2 shows the wire soldered to the band. Sufficient solder is used on the surface of the band to form a round hole of the wire. The solder while filling the angles made by the

wire and band surface adds to the strength of attachment. More solder than is shown in the illustration may be used and a more exact hole can be made with a small burr. After soldering, the rough ends of the wire may be made smooth with a small stone and then polished. It will be noticed that a firm attachment is provided, and that a wire placed in this ring is in close proximation with the band, affording and facilitating an exact adjustment. This also applies to a tube made of metal plate in like manner.

For those desirous of shaping wire to make these rings, I will describe the die which I used and which is illustrated in Fig. 3. A groove was first made with a thin carborundum disk in the end of a drawplate. A transverse groove was then made for the reception of the wire. This was done with a small burr and stone. While the transverse groove may not be necessary, notches should be made in the plate at *A*, Fig. 2, that the wire may be formed so as to provide for the angular spaces (Fig. 2, *A*) which are filled with solder in the soldering. A small steel wire flattened a little with a file is the male part of the die. With the wire positioned as in Fig. 3, a large hammer is used to seat the steel wire, shaping the wire for the ring and flattening the ends. Wire .020 gauge and about an eighth of an inch in length may be used for the ring. However, any size to suit the case may be employed.

A LOOP-WIRE SPLINT

By Harry P. Beaser, D.D.S., Fresno, Calif.

TO orthodontists, the loop alignment wire has proved to be practically indispensable. The loop principle is used in many different forms of appliances for treatment of malocclusion. The use of it, however, does not stop with orthodontics. It can be applied successfully by oral surgeons in the reduction of fractures of the maxillæ and mandible. The cuts here shown exhibit the second of two cases which have been referred to me for treatment, by a general surgeon.

The splint was first sought out for its rigidity, in order to relieve the patient of the necessity of having the jaws locked together by the usual means to insure a good occlusion, and the loop was added to the wire for the purpose of adjusting the broken parts to their normal position.

Fig. 1 shows the appliance as it appears out of the mouth, and Fig. 2 shows it in position on a plaster model, the black line on the model indicating the position of the fracture in this case.

The construction of the splint is very easy, and if it is possible to have the patient come to the office, the entire work will not take more than an hour or so. Two plain bands are fitted to teeth on each side of the fracture. It is best, however, not to band the two teeth approximating the fracture, as they are usually very unstable and would not give the necessary support. There is also a danger of causing irritation at the point of fracture.

The lap-joint band is much better than the ordinary pinch band for the

molar teeth, but all bands should be made to fit rather loosely so that they will slip on and off easily during the construction.

The two bands are soldered together with a short piece of 16-gauge wire. Free-hand soldering can be done and should be, to avoid taking impressions which are painful to the patient and usually quite inaccurate at best.

The short tie-wire would in most cases, be placed lingually with the long loop-wire labially, but if the conditions of the surrounding tissue interfered, the order could be reversed.

The best way to measure the wire accurately, is to solder one end to the distal band, and then mark its position on the other band with a sharp instrument. After soldering to the second band, any slight adjustment necessary can be made with the pliers or wire-stretchers.

When both sets of bands are soldered and replaced in the mouth, the loop-wire is then made. Sixteen-gauge wire is sufficiently large for the average case, but if deemed necessary, a larger gauge could be used. Anything smaller, however, would be likely to spring, if the muscular force was very strong.

The loop is placed in the wire at a convenient point, but should be as near the line of fracture as possible to permit a little finer adjustment at this point,

Fig. 1.

Fig. 2.

especially if the break occurs in the canine region. The two broken parts of the bone can be held together and the loop-wire bent and cut to approximately the right length and shape; then, as before, solder the distal end to the distal set of bands. Figs. 1 and 2 will show this very plainly. After this is done, place the bands in the mouth and mark on the anterior set of bands the approximal position of the anterior end of the loop-wire, remove all from the mouth, and solder. The appliance is now ready for finishing, and after smoothing down all rough corners, etc., is ready to cement. This can be quickly and easily done with the aid of the assistant or without an assistant. Any one familiar with cementing more than one band at a time will find little difficulty. After a sufficient length of time has elapsed to permit the cement to set thoroughly, the finer adjustment can be made. I have found that 16-gauge noncorrosive wire thoroughly annealed, possesses the best qualities for adjustment and rigidity.

Grasp the loop firmly with a strong pair of pliers and draw the parts together, at the same time forcing the teeth into their proper occlusion. The loop allows of movement in any direction and the wire will hold the parts in this position without further assistance. All bandages can be removed and the wiring together of both jaws will be found unnecessary except in very extreme

cases, such as bad complex and multiple fractures, and not always in those. The advantage the loop splint has over other jaw splints is that it will perform the service necessary with the least amount of material. The inconvenience to the patient is no more than that felt by any patient wearing an orthodontic appliance, and a more complete prophylactic care can be given.

The patient can talk and eat with practically as much ease as before meeting with the accident, and no unsightly bandages, etc., are necessary.

Fig. 3 shows the splint in the mouth directly after cementing to place, and Fig. 4 the same after adjustment. Note the occlusion of the teeth. This case was the result of an automobile accident in which the patient suffered quite a number of other bruises and broken bones, but a few hours after the adjustment of the loop splint, practically all pain had left this region and the fact that he

Fig. 3.

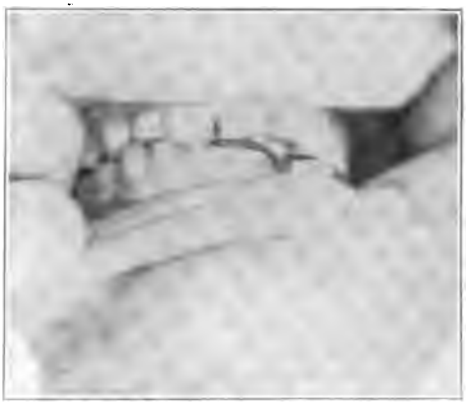

Fig. 4.

could eat a good meal, smoke a cigar, and talk, gave him a brighter view of life and materially hastened his recovery.

Many forms of splints have been invented from time to time, and the necessities of war have brought out many more near the battle front or in the base hospitals of Europe. The use of metals for this purpose has superseded all other materials as it is much more efficient and cleanly and permits the muscles of the mouth to remain in their normal position of rest without strain.

It is reported that some of the English surgeons in France have placed bands either side of a fracture with long wires soldered to them that overlap, and when the fracture is set, the overlapping wires are fastened together with soft solder in the mouth. The results of this method are probably efficient, but must necessarily be very rough and hard on the patient.

By using the loop-wire instead of the above, the splint could be constructed as quickly and with more satisfactory results.

ENDOCRINODONTIA, OR THE DUCTLESS GLANDS—THEIR EXPRESSION IN THE HUMAN MOUTH

By Herman E. S. Chayes, D.D.S., New York City

PART I

THERE are many people who are perfectly well; their daily life is often one of intense physical and mental activity, and yet they rarely, if ever, require therapeutics or mechanical attention. There are others who are miserably ill, mentally and physically, their daily life is one of continued attempt to guard against further encroachment by disease. They are continually under the care of some one ministering to some of their ailments successfully or otherwise. Some people for a period of time are perfectly well, then, for some obscure, and to most observers, unaccountable, reason, sicken or fall seriously ill, to recover in the same obscure and unaccountable manner and continue to live and to work, without further interference from disease, for their allotted number of years.

In corollary with the above, there are many people whose dental apparatus is in perfect balance, mechanically expressed, in perfect occlusion, who never require any dental interference; still others whose teeth were in imperfect condition, as expressed in malocclusion, have had them placed in balance, and subsequently require an incessant amount of dental interference to keep on repairing and replacing parts of the continually breaking down apparatus. Some people never pay any attention to the cleanliness or the environment of their teeth, and yet they never need to, nor do they seek dental interference for the alleviation of any dental disorder. There are others who are constantly having their teeth cleaned, their roots scraped and their gums scoured, and still their teeth continue to present new cavities, new breakdowns, new dystrophies.

Manifestly, the correction of bodily health and tooth health is not clearly understood.

Many physicians, many surgeons, many dentists will readily admit the truth of the foregoing and attest to the statement that they are and have been constantly on the alert for some thing, some truth, the understanding of which would enable them to more effectively handle and efface bodily disorders.

May it not justly be said, right here, that the cause of medical and dental ineffective ministrations has been due to the classification of cases of patients in the aggregate under the heading of certain diseases, when we should have devoted our attention to the close study of the individual constitution of each patient, and so learn to treat an aggregate malady in an individualized way.

It is a fact that the same disease will express itself differently in different individuals, and yet, if we take up our works on therapeutics, we shall find a woeful lack of individualization of cases calling for treatment.

Under the heading of "Pneumonia," the pneumonia is treated, under the heading of "Diphtheria," antitoxin is advocated. Tuberculosis has its prescribed order of treatment, etc. It is always the disease, almost never the patient.

We have become so obsessed with the pathologic anatomy of the case that we fail to recognize the ever receding voice of God in the individual, struggling with all the normal that is in him, to overcome the very picture we take as a guide to our treatment. It is so in dentistry, we see the teeth of children decay, and we either remove the teeth and disturb the arch; or we fill the teeth which have decayed, and allow the child to go with the predisposition to decay in the constitution, unrestricted to work its further havoc.

We see a case of so-called traumatic occlusion and we begin to file and grind the teeth into more or less acceptable stress relationship, paying no attention to the particular "ism" in that particular constitution which caused the arrangement of teeth ultimately bringing about the traumatism that sent the patient to us in search of relief.

A woman becomes pregnant, bears and gives birth to a child, many of her teeth begin to decay, she loses one or two of them, during the period of lactation, she seeks our advice and help, and we dentists, in almost every instance, fill the decayed teeth and replace the lost ones and dismiss her to go through the same dental ordeal, should she be called upon, in her relation as a wife, to again become procreatively active.

A case of pyorrhea presenting for relief, the patient is either pyrocided, vaccinated, scaled, scraped, scalded, rubbed and drugged locally, a few teeth are lost, being too far gone; a few are filled, not far enough gone; a few are crowned with golden caskets and the bill paid, the patient is allowed to go and take the pyorrheal potential in his or her constitution, the attack recurs with renewed virulence and renewed destruction.

Time to change about it seems to me, time to realize that we have not been dealing with the fundamental facts of the cases in our treatment of diseases.

All the bacteriology we know has not enabled us to eliminate effectively diseases the bacteria of which we know best and are most familiar with.

Time to realize and to profit from this realization that there are, for example, any number of individuals to whom we could feed sandwiches made up of bread and pneumococci and who would be none the worse for the diet. This is equally true of all germs, not excepting the most virulent of streptococci.

Some people's teeth will not decay in spite of the lack of any attention on their part or the dentist's part.

Some people need but the least exposure to contract all sorts of diseases. Some people's teeth decay in spite of all attention. Some children never have any infectious diseases, some have all sorts of afflictions.

Wonderful resistance in the apparently immune specimens, lowered resistance in the others. Yes, my friends, but what is this resistance? Why are some possessed of it and why not the others? Where do they who have it get it, and what do those who suffer lack, in order to make it?

Patients have become habituated to seek a physician so he may see the disease. Physicians should become habituated so that when they look at and for a disease they should see the patient.

Patients have become habituated to go to the dentist so he may look at and after the teeth.

Dentists should become habituated so that whenever they look at a tooth decayed or healthy, they should see the patient.

All this does not mean revolution, neither does it mean a reactionary program, it simply means a broadening of our vision, a more comprehensive understanding, and hence a more effective service in our field of endeavor.

The endocrines are the organs of internal secretion.

Endocrinology is the study of the organs of internal secretions and the study of the functions of these organs.

Secretion is a specialized function of certain glands made up of highly specialized epithelial cells (secreting cells) in the exercise of which function, they take up substances from the blood stream and elaborate these substances into products wholly at variance in appearance and effect with the substances which were taken up, and discharge these products by the avenue of special channels or ducts into various organs of the vegetable, animal, or human anatomy, to effect the physiologic expression of these organs.

Internal secretion may be defined in the same terms, except that there are no special channels or ducts through which the products elaborated by the ductless glands are conveyed to the various organs; so that these products may be said to find their way into the various parts of the body by directly entering the blood stream.

The products of the ductless glands or glands of internal secretion have been termed hormones from the Greek word, to excite.

Their influence upon the functions of the various organs of the body is one of augmentation or excitation and, under some circumstances, one of inhibition.

The potency of these products is practically independent of quantity and wholly interdependent as to quality. In this respect, they are very much akin, if not wholly like enzymes or ferments.

They are in such a fine state of subdivision that they may be likened to electroatomic messengers communicating and carrying orders or directions or aid from the vegetative centers to all parts of the body with which they communicate at all.

The most important ductless glands as we know them are, first the pineal, a small gland situated at the base of the pituitary body.

Second, the pituitary body, a very vascular gland, consisting of an anterior, middle and posterior portion, all situated in the cella turcica of the sphenoid bone. Governs periodicity, rhythm, influences growth, nutrition, reproduction, the psychosis, and is influenced by the thymus, the thyroid, the gonads, and the adrenals.

Third, the thyroid gland and the parathyroid bodies. The first consists of two lateral lobes, disposed on either side and in front of the larynx and upper three or four rings of the trachea. The parathyroid bodies are arranged on either side of the median line and may be found as low as the seventh tracheal ring. The thyroid is a very vascular body of gland tissue, it is supplied by the superior and inferior thyroidal arteries, which form a rich anastomosis. The veins are correspondingly free and numerous, they are valveless and empty into the jugular and innominate veins. Influences nutrition, growth, reproduction and is profoundly influenced by functional and organic disturbances of the alimentary canal and the gonads.

Fourth, the thymus develops as a paired sac-like diverticulum of the ventral portion of the third and fourth and possibly the second pharyngeal cleft. This sac-like beginning of the thymus is entirely epithelial in structure. Influences metabolism in the child, also the thyroid, the pituitary and the gonads, and is itself markedly affected by pituitary and adrenal disturbances.

Fifth, the suprarenal capsules, adrenal bodies, are two small, flattened, glandular bodies located in the back part of the abdomen, above and somewhat anteriorly to the upper part of each kidney. They consist of a corticle and medullary portion, they are exceedingly vascular, with abundant lymph supply. The nerve supply is significant, being derived from the solar and renal plexuses and getting branches from the phrenic and pneumogastric nerves. Their important connection with the sympathetic is today well known. Dr. Joseph Fraenkel terms the sympathetic nerve "the frozen adrenal" attempting to convey the impression that it is a continuous line, icicle as it were, of projected adrenal substance. The adrenals play a most important part in the development of the being; a tremendous part in the mental growth of the being. Virtually, the great center of the anatomic nervous system, they have been called the abdominal brain, they control energy and the decorative scheme in the body; they have everything to do with pigmentation, with oxygenation of the blood; they influence the thymus, the thyroid, the pituitary body and the sexual organs, and are themselves markedly affected by thyroidal, pituitary, and gonadial influences.

Sixth, the gonads, the organs of immortality on the procreative plane or better, the instruments whereby man perpetuates his species on earth. In children the gonads are markedly influenced by the thymus, the persistency of which will retard adolescence. In children of normal development, the thymus goes out at puberty and the thyroid with its regulating and supervising influence comes in. At that time also, the assertive period of the gonads becoming manifest, they call on the adrenals in the male and on the pituitary in the female to set up an intercommunicating system of harmonic relations, which result in a most intimate interdependence, very apparent in the female during menstruation, pregnancy, childbirth, and lactation, in the male during periods of great physical stress, excitation or copulation or of sublimation of the procreative urge into intellectual or intuitional poetic expression, in other words during inversion of procreation to creation.

The foregoing may be summed up rather crudely as follows:

Thymus—Youth.
Thyroid—Quality and equilibrium.
Pituitary—Bulk and disposition (psychosis).
Adrenal—Energy and decoration.
Gonads—Immortality or procreation.
Pineal—Intelligence, soul or cosmic relationship (?).

The normal, augmented or inhibited activity of one or more or all of these glands is manifested in diverse ways in the human, dental apparatus, and it is to the recognition and the study of these manifestations, that I have given the name of "Endocrinodontia."

The thymotrop, the thyrotrop, the pituitotrop, the adrenotrop and the gonadotrop are names or designations appended to individuals who exhibit in their makeup, a preponderance of thymic, thyroidal, pituitary, adrenal, or gonadial influences, as the case may be.

(To be continued in April issue.)

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

ANATOMY OF THE TEETH AND JAWS, WITH SPECIAL REFERENCE TO ROENTGENOGRAM INTERPRETATION

By Robert H. Ivy, M.D., D.D.S., Milwaukee, Wis.

Major, Medical Reserve Corps, U. S. A.; Associate Surgeon, Columbia Hospital, Milwaukee; Formerly Instructor in Oral Surgery, University of Pennsylvania

IN the passage of the roentgen rays through the tissues, the denser the tissue the greater the obstruction offered to the rays, and consequently the lighter will be the image in the negative.

In roentgenograms of the jaws, the substances depicted in the order of their density, beginning with the densest, and therefore the lightest in the negative, are:

1. Metallic crowns and fillings, and root canal fillings containing zinc or other metals.
2. Enamel of the teeth.
3. Dentine.
4. Cementum.
5. Cortical bone.
6. Cancellated bone.
7. Medullary spaces, canals, foramina in bone, and soft tissues.

In disease, the normal condition of a given tissue may be changed either to a lessening in density, meaning abstraction of lime salts, with consequent deepening of the shadow in the x-ray negative, or an increase in density, due to a deposit of lime salts, and indicated by a lessening of the shadow.

A familiarity with the anatomy of the teeth and jaw bones is one of the fundamental essentials for correct interpretation of roentgenograms. Lack of this knowledge is frequently a cause of mistaking of normal shadows for manifestations of disease.

The teeth are set in sockets in the alveolar process, being attached by the peridental membrane. The alveolar process is composed of spongy or can-

cellated bone (Fig. 1), which appears in the roentgenogram as a fine interlacing network. The sockets of the teeth are lined with a thin plate of dense bone, which is shown in the x-ray negative as a fine white line around the tooth. Between this line and the tooth itself is a narrow dark space representing the peridental membrane. *These lines are important landmarks in the interpretation of roentgenograms, as their absence or deviation usually means some pathologic condition* (Fig. 2).

Fig. 1.—Showing cancellated bone of alveolar process. (Cryer.)

Fig. 2.—Upper right central, lateral, and canine. Pulps vital, no periapical abnormality. Floor of nose and maxillary sinus barely shown as dark shadows above. The thin dark peridental line and dense white bony line are seen about roots. Fillings shown as dense white spots.

ROENTGENOGRAPHIC ANATOMIC LANDMARKS IN THE UPPER JAW

At a varying distance above the apices of the central and lateral incisor teeth is found the *floor of the nose* (Fig. 3), sometimes seen in the roentgeno-

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 3.—Anterior view of skull, showing anterior opening of nasal chamber. (Cryer.)

Fig. 4.—Upper right central forms abutment to poorly fitting bridge, which extends to left canine. Upper left central and lateral have been lost. No periapical abnormalities. The dark area above is the nasal fossa.

Fig. 5.—Upper right lateral incisor shows post for support of crown, no other root filling. Ill-defined dark area about apex due to chronic rarefying osteitis with suppuration. Nasal fossa with inferior turbinate well shown above.

Fig. 6.

Fig. 7.

Fig. 6.—Showing considerable thickness of bone between the apices of the molar roots and the maxillary sinuses. (Cryer.)

Fig. 7.—Showing smooth prominences in floor of maxillary sinus overlying apices of roots of premolar and molar teeth. (Cryer.)

gram as a dark shadow which might be mistaken for a cystic or abscess cavity in the bone (Figs. 4 and 5).

Above the apices of the premolar and molar teeth is found the maxillary sinus or antrum of Highmore. This sinus varies very much in its extent, shape, and in the relation of its floor to the roots of the teeth. Sometimes there is

Fig. 8.—Showing floor of maxillary sinus dipping down between roots of molar tooth, the apices thus being above the level of the floor. (Cryer.)

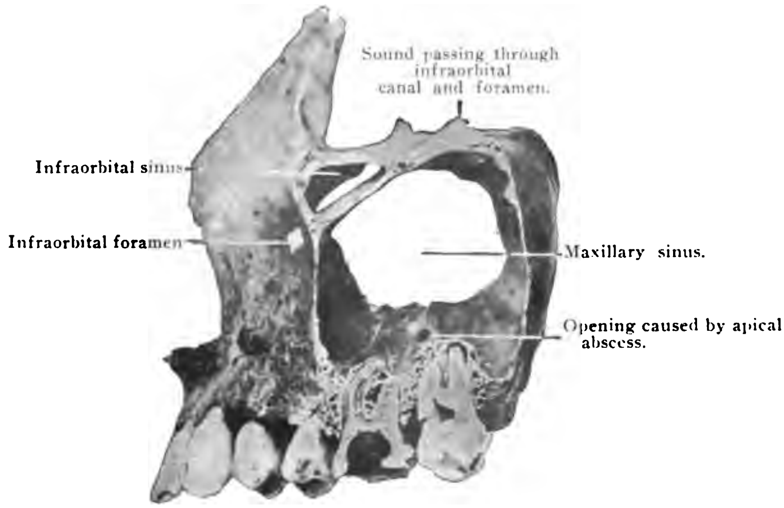

Fig. 9.—In this specimen the maxillary sinus does not extend much anterior to the first molar. (Cryer.)

a considerable thickness of bone between the tooth apices and the sinus (Fig. 6). In other cases the tooth apices come right up to the floor of the sinus, even forming projections into the cavity, though under normal conditions always

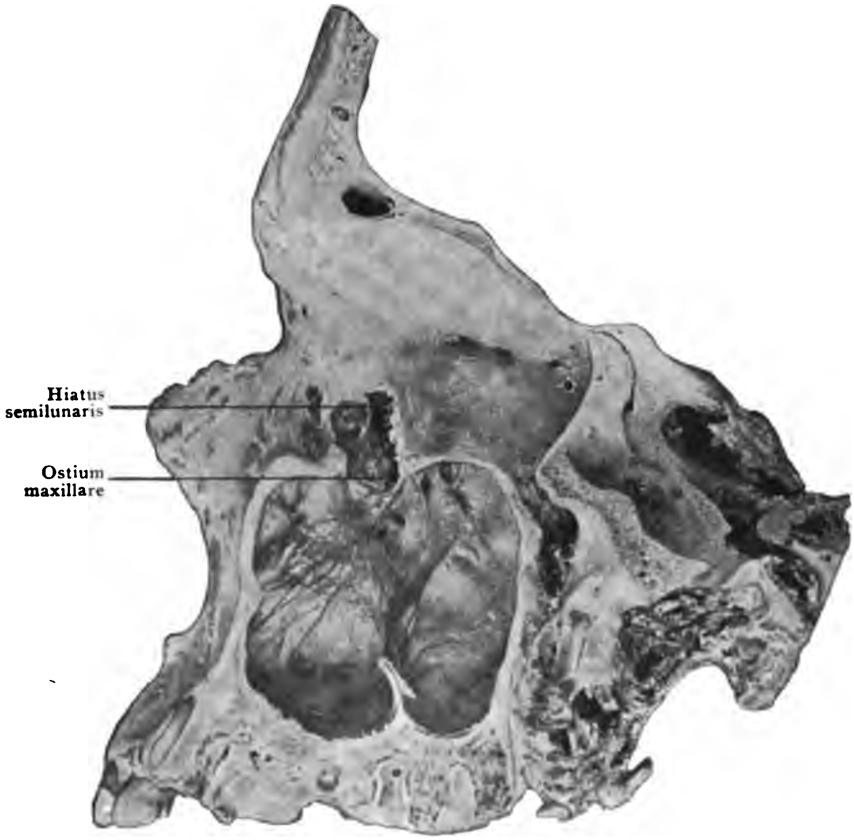

Fig. 10.—Here the floor of the maxillary sinus extends in front as far as the region of the first premolar tooth. (Cryer.)

Fig. 11.

Fig. 12.

Fig. 11.—Upper right canine normal. First premolar good root filling, apex extends close to floor of maxillary sinus. First molar roots apparently project into maxillary sinus, but in reality are in the wall of the sinus; furthermore, this tooth has a vital pulp.

Fig. 12.—Upper right canine and premolar normal. First molar roots project above level of floor of maxillary sinus, but the normal dense line of bone can be seen surrounding the roots. The pulp of the tooth also is vital.

separated from it by a thin lamina of bone (Fig. 7). Sometimes the ends of the roots are found well above the most dependent portion of the sinus, but located in its wall (Fig. 8). The floor of the maxillary sinus is usually found in relation to the roots of the molar teeth (Fig. 9), but may extend as far forward as the first premolar or canine (Fig. 10). These varying relations of the floor of the antrum of Highmore to the roots of the teeth are well shown in x-ray negatives, the cavity of the antrum appearing as a dark shadow which must not be mis-

Fig. 13.

Fig. 14.

Fig. 13.—Showing anterior palatine fossa just behind and between the upper central incisor teeth. The posterior palatine canal is seen as a groove running parallel to and just within the line of the molar teeth. (Cryer.)

Fig. 14.—Upper central incisors. Sharply defined dark area between roots is anterior palatine fossa, somewhat resembling the appearance of bone destruction and cyst formation. Both teeth, however, contain vital pulps, and normal peridental line can be followed around each root.

taken for a rarefied disease area. It is sometimes difficult in the study of roentgenograms of this region to determine whether or not the roots of the teeth project into the maxillary sinus and whether areas of absorption about the roots communicate with it. In the roentgenogram, where a root is projected above the level of the floor of the antrum, it is important to seek carefully the dark and light lines found around normal teeth in order to differentiate the normal condition shown in Fig. 8 from pathologic conditions in which roots communicate with the cavity of the sinus (Figs. 11 and 12).

In the upper jaw, on the palatal surface just behind and between the central incisor teeth is found the *anterior palatine fossa* (Fig. 13). This contains

foramina carrying blood vessels and nerves from the nose. In roentgenographic films of the anterior teeth this fossa is frequently seen as a dark shadow above and between the apices of the central incisors, and when in close relation to roots of teeth under suspicion, might be mistaken for rarefaction due to disease of the bone (Fig. 14).

The *posterior palatine canal* (Fig. 13), is found in the form of a groove running posteroanteriorly in the roof of the mouth mesially to the molar teeth. In the roentgenographic film it is occasionally shown as a dark shadow in the wall of the antrum in close relation to the palatal roots of the molar teeth.

ROENTGENOGRAPHIC ANATOMIC LANDMARKS IN THE LOWER JAW

Here the principal roentgenographic anatomic landmarks are the *mandibular canal* and the *mental foramen* (Fig. 15). The *mandibular canal* runs postero-

Fig. 15.—Showing cancellated internal structure of mandible, with mental foramen below and between roots of premolar teeth. (Cryer.)

anteriorly below the apices of the teeth, and sometimes in very close relationship with them (Fig. 21). In the roentgenogram the root of a lower molar may apparently project into the dark space representing the canal, yet in reality be situated to one side or the other.

The *mental foramen,* situated below and between the lower premolar teeth, may easily be mistaken for an area of disease associated with one of these teeth, particularly if there are clinical signs giving a suspicion of trouble (Fig. 16). Very frequently, however, the connection of the mental foramen with the inferior dental canal can easily be seen in the roentgenogram (Fig. 17).

In films of the upper premolar and molar region the overhanging malar bone frequently casts a shadow which obscures the roots of these teeth (Figs. 18 and 19).

ANATOMIC LANDMARKS IN ROENTGENOGRAPHIC PLATES OF THE JAWS

In a lateral roentgenographic *plate* of the upper and lower jaws, made with the head in the position shown in Fig. 20, attention is called to certain anatomic landmarks, which are shown in Figs. 21 and 23, and diagrammatically in Figs. 22 and 24. The upper and lower teeth of the side examined are usually well shown from the third molars forward to the canines. In the anterior portion of such a plate, the shadow of the opposite side of the jaws overlies that of

Fig. 16.

Fig. 17.

Fig. 18.

Fig. 19.

Fig. 16.—Lower right canine normal, first premolar normal; second premolar pulpless, imperfect root filling, periapical thickening of peridental membrane. Between and below apices of premolars is seen a dark area due to mental foramen.

Fig. 17.—Lower right first premolar, pulpless, apparently good root filling, no periapical abnormality. Second premolar recently removed. Inferior dental canal seen curving up to mental foramen near socket of this tooth. First molar, large filling and caries of crown. No abnormality of bone.

Fig. 18.—First premolar crowned, two roots, one much foreshortened; good root fillings, apices normal. Other teeth normal. First molar missing. Second and third molar roots overshadowed by malar bone.

Fig. 19.—Upper left premolars, pulps vital, periapical regions normal. Circumscribed dark area about apex of second premolar somewhat resembling an area due to rarefying osteitis is only due to a recess in the maxillary sinus; the normal line of bone can be traced completely around the apex of this tooth. Light shadow in upper left corner is due to malar bone.

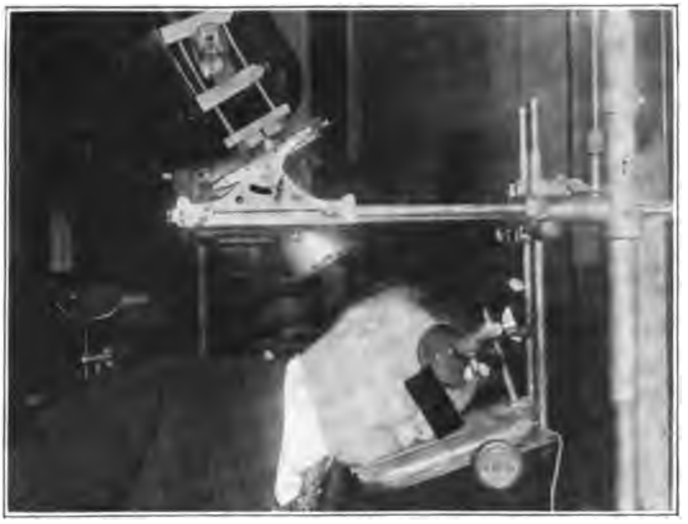

Fig. 20.—Position of head and angle for left side of jaws.

Fig. 21.—Plate of right side of face, with head placed especially to show molar region. Horizontal impaction of lower third molar. (See Fig. 22.)

the side nearest the plate, the amount of overlapping depending on whether the patient's nose is pressed down on the plate or slightly raised from it. In the same way the position of the head affects the overlapping of the molar region by the shadows of the vertebræ at the posterior portion of the plate. The dark space above the upper teeth is formed by the maxillary sinus and the nasal fossa. Into this space occasionally may be seen projecting the coronoid process of the opposite side of the jaw. Above the maxillary sinus and nasal fossa, the honeycombed appearance is due to the ethmoid cells. Below the roots of the lower

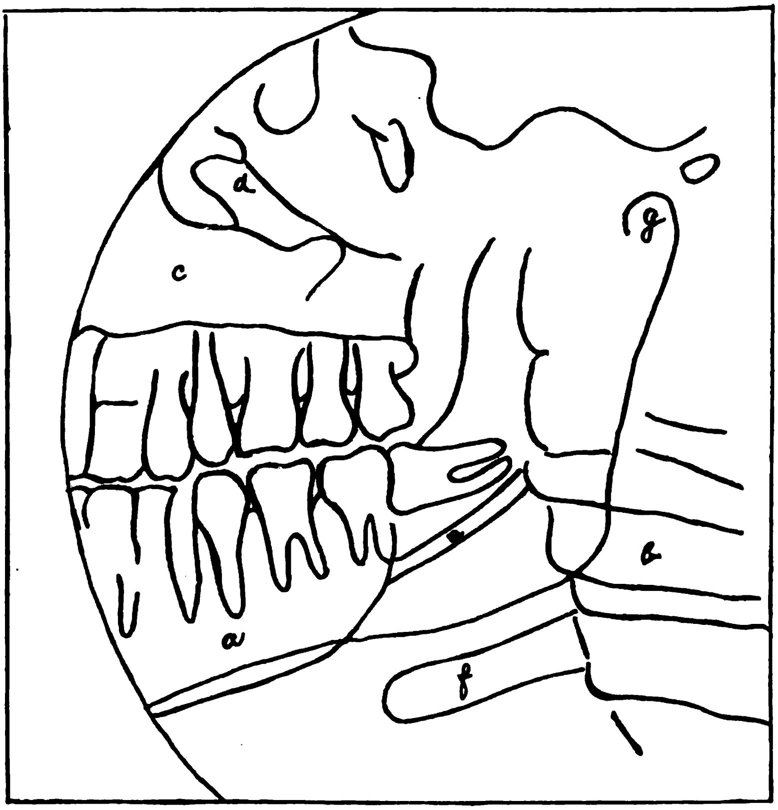

Fig. 22.—Diagrammatic illustration of Fig. 21.

(*a*) Portion of lower jaw overlapped by shadow of opposite side.
(*b*) Vertebræ.
(*c*) Maxillary sinus and nasal fossa.
(*d*) Region of ethmoid cells.
(*e*) Mandibular canal.
(*f*) Hyoid bone.
(*g*) Condyle of mandible.

molar teeth may be seen the mandibular canal, running forward to the mental foramen between and below the apices of the premolars. Below the lower border of the mandible, extending in front of the vertebræ as far forward sometimes as the first molar, the hyoid bone is shown. In plates taken to show the molar region, the ramus and condyloid process of the mandible can frequently be traced up to the joint.

Fig. 23.—Plate of left side of face, showing normal anatomic landmarks and impacted upper third molar. (See Fig. 24.)

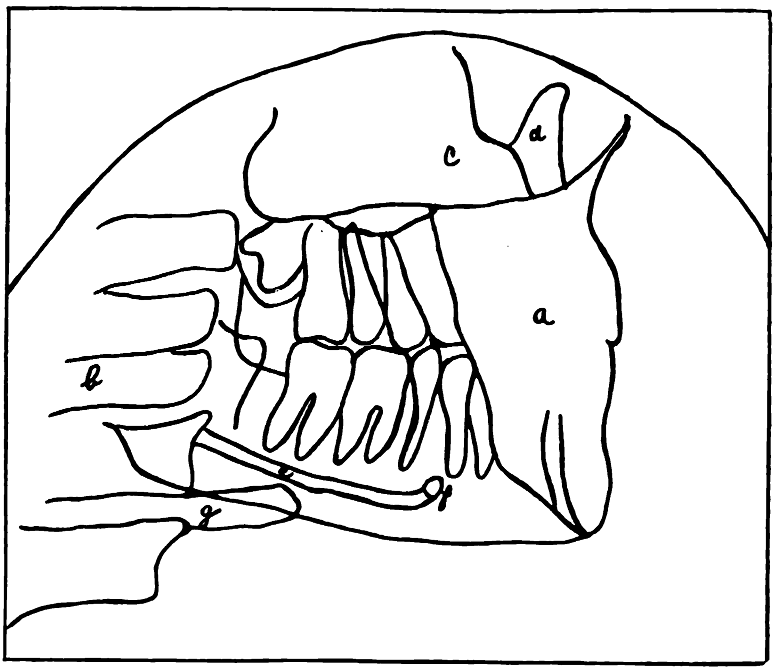

Fig. 24.—Diagrammatic illustration of Fig. 23.

(*a*) Portion of upper and lower jaws overlapped by shadow of opposite side.
(*b*) Vertebræ.
(*c*) Maxillary sinus and nasal fossæ.
(*d*) Coronoid process of right side of mandible.
(*e*) Mandibular canal.
(*f*) Mental foramen.
(*g*) Hyoid bone.

A NEW DENTAL ROENTGENOGRAPHIC FILM HOLDER

By Norman C. Prince, M.D., Omaha, Nebr.

Attending Roentgenologist to the Omaha Free Dental Dispensary for Children; Etc.

HAVING tried most of the dental film holders on the market and found them wanting in some way and also realizing that to have the patient endeavor to do the job is anything but satisfactory, I determined to get up some device that would make dental roentgenography somewhat less irksome. Having determined that holding the film with the thumb was the most satisfactory method, I endeavored with this device shown in Figs. 1 and 2 to imitate this as nearly as possible.

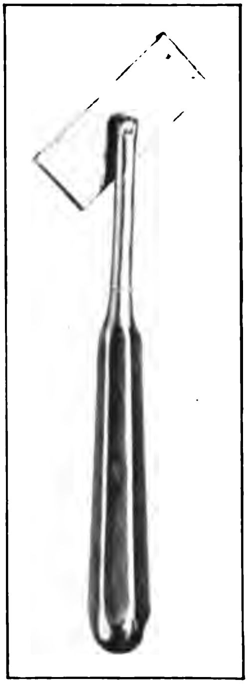

Fig. 1.

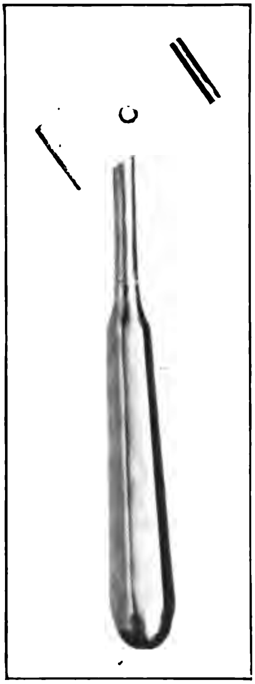

Fig. 2.

The instrument is composed of a small piece of thin metal $1\frac{6}{8}$x$\frac{5}{8}$ inches with a turn on either end so the film may be held firmly. This enables one to use various widths of films from the narrowest to the broadest. A small piece of metal is riveted into the center of this so that it will revolve freely, and onto this small piece a handle is fastened with a hinge joint. This gives a complete universal joint. The holder is placed in the mouth with the firmly held film in position. The patient now holds the handle firmly and the exposure is made.

From the fact that the handle can be placed at any angle to the plane of the film, it is very simple to use this device, and I believe it will become very useful to those doing dental roentgenography. The entire instrument is nickel plated and between exposures is placed in a weak antiseptic solution.

The Fifty-first Annual Meeting of the Tennessee State Dental Association will be held in Nashville, Tennessee, June 17, 18, and 19, 1918.—Geo. L. Powers, Secretary, Paris, Tenn.

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EDITORIALS

Malocclusion and Mouth Infection

AT the present time the medical and dental professions are paying a great amount of attention to mouth infection, and various causes have been given for the production of the condition. Mouth infection is a term that has been coined in late years to include a condition in which the oral cavity is laden with germs to such an extent as to become a detriment to the individual, in a great many cases producing systemic effects.

It must be remembered that in the mouth of every individual there are always some germs present, but it is only when the germs become so numerous as to produce disease of the tissues in the oral cavity with resulting systemic disturbances that we think of the condition as being one of mouth infection. There is no question but that mouth infection primarily is produced by some microorganism, but as microorganisms are present at all times, in order to

make possible infection of the oral cavity, some condition must exist that is conducive to their increase. When we begin to look for a cause, we find that the principal factor, after the germ itself, in the production of mouth infection, is malocclusion.

Malocclusion is considered by some men who have made mouth infection a study as being more important in the production of this condition than any other one thing. The life of every individual is simply one continuous fight between the cells of his body and the invading microorganisms, a continuous battle is going on between the leucocytes and the germs, and finally the time comes when the germ gets the better of the argument and the individual succumbs to the attack of the invading organism. Therefore, in order to make this battle more favorable for the cells and for the individual, everything possible should be done that will prevent the growth and multiplication of the microorganisms or the invading germs. Now one of the things which allows the germs in the mouth to become numerous is malocclusion, producing the abnormal placing of the teeth, improper position of the contact point, which makes the proper cleansing of the mouth impossible. It has been contended by some that if teeth had normal occlusion and the individual masticated the proper kind of food, mouth infection would practically be an unheard of thing even without the aid of any artificial means of cleansing the teeth. However, at the present time individuals do not masticate their food properly, and, as a rule, do not have the kind of foods that require a vigorous mastication.

Various artificial means have been introduced for cleansing the oral cavity, which are very good and proper. We do not advocate that because individuals have normal occlusion they should never brush their teeth, but we do say that an individual whose teeth are in normal occlusion can more thoroughly cleanse his oral cavity than the individual whose teeth are in malposition. Take the majority of individuals suffering from mouth infection, and you will find they first were sufferers from malocclusion. These malocclusions may have existed from childhood, or they may have been produced by improper filling and restoration, or by the extraction of teeth; but the fact remains that the malocclusion exists from some cause, at the time the mouth infection becomes apparent. It is also strange that we find a large number of mouth infections present in individuals who have spent considerable time in cleansing the teeth. We are willing to admit that they did not succeed in cleaning the teeth or probably the mouth infection would never have occurred. The fault of improper cleansing may have been the result of improper methods, but in a large number of cases it has been the result of insufficient cleanliness owing to the malposition of the teeth. We have observed very young individuals with malocclusion in whom mouth infection was very manifest.

We have seen existing infections treated, the teeth placed in proper occlusion, with the result that infection did not occur again during the period the case was under observation. We can not say that an individual who has a set of teeth in normal occlusion will never have a case of mouth infection, but we can say that he will not be so liable to as the individual whose teeth are in malocclusion. We can practically rest assured that an individual whose teeth are in malocclusion will suffer from mouth infection before he is forty years

of age regardless of any care or treatment that he may give his teeth at the present day and age.

Realizing that malocclusion is such an important factor in the production of mouth infection, we are surprised that dental literature does not contain more on the subject. Only in the last few months there has appeared a dental textbook that has given considerable space to mouth infection in which the author has failed to mention malocclusion as being one of the contributing factors to the condition. It seems to us a very foolish procedure for writers to advocate the continual cleasing and brushing of the teeth, the use of prophylactic means, when they neglect the first and most important prophylactic measure nature has provided; namely, the teeth in normal occlusion, with the surfaces of those teeth made as nearly as possible self-cleansing.

We believe the time is not far distant when the most important advice given regarding prophylactic measures, the most important means regarding the prevention of mouth infection, will be that the teeth be placed in normal occlusion. We believe that malocclusion will be recognized as a pathologic factor in the production of mouth infection.

American Institute of Dental Teachers

AT the last annual meeting of the American Institute of Dental Teachers, held at Pittsburgh, Pennsylvania, January 29-31, 1918, the following officers were elected: President, Dr. A. W. Thornton, McGill University, Dept. of Dentistry, Montreal, Que.; Vice-President, Dr. R. W. Bunting, Ann Arbor, Mich.; Secretary-Treasurer, Dr. Abram Hoffman, 381 Linwood Avenue, Buffalo, N. Y.; Executive Board, Dr. A. D. Black, Chicago, Ill.; Dr. G. S. Millberry, San Francisco, Cal.; and Dr. A. H. Hipple, Omaha, Neb.

The next annual meeting will be held January 28, 29, and 30, 1919, the place of meeting to be announced later.

The Use of Suitable Metals for Orthodontic Appliances

A FEW years ago the question of the selection of metals to use in the construction of orthodontic appliances was considered from the appearance of the metal and its cost. Appliances were divided into base and noble metal appliances, and the principal points in choosing the appliance were the cost of construction, the appearance, and the antiseptic value of the metal forming it. When all appliances were practically of the same style, the question of the selection of metals was a much simpler proposition. As the treatment of malocclusion became more important and the construction of an appliance to fit the particular case was given more consideration, and appliances were divided into labial and lingual devices, the question of selecting the material became more important than it was in times past. Even in the selection of an ordinary labial alignment wire it is important to consider what is to be accomplished by that wire when considering the material of which to construct it.

If the alignment wire is to be used for the expansion of the dental arch

which must be accomplished by the elasticity of the alignment wire, one metal of a certain gauge might be suitable, whereas, if the alignment wire was to be used for increasing the length of the arch by the use of the screw, another gauge and another material might be more suitable. In the construction of bands the metal which is selected must be considered with regard to its strength as a band material, the ease with which it can be conformed to the tooth, and its antiseptic properties. Unfortunately, at the present time we cannot find all of the desired qualities in one band material, consequently the kind of band material which is used will have to be decided upon the likes and dislikes of the operator which should be governed by the clinical condition of the teeth. In the mouth of an individual whose teeth show decided tendency to caries, it would be very poor judgment to use a band material that did not possess antiseptic properties. Again in the mouth of the patient who keeps the teeth religiously clean and where there is evidence that the band material will be subjected to considerable stress during mastication, the selection of a stronger and stiffer band material, even though it does not possess antiseptic properties, may be advisable. When we come to the selection of the material or metal of which the appliance is constructed, we must be governed almost entirely by the style of the appliance that is to be used, and the manner in which the force is to be exerted on the malposed teeth.

We have already mentioned some of the conditions that enter into the selection of the ordinary labial alignment wire, but, we must consider the fact that in the conditions in which we formerly used the ordinary labial alignment wire we now have ribbon arches fitted to the appliances, labial arches with finger springs, and lingual alignment wire. We even have the lingual alignment wire which is soldered on the band where the force is obtained by the means of the wire-stretching pliers, and the lingual alignment wire which can be removed from the molar attachment and which exerts force on the malposed teeth by the elasticity of the metal of which it is constructed.

In considering, then, the two types of lingual alignment wires which we may roughly classify as fixed and removable, it should be very apparent to every one that metal suitable for a removable lingual alignment wire, which exerts force upon the teeth by means of its elasticity, would not be advantageous for the lingual alignment wire where the force is exerted by means of the wire-stretching pliers.

Dr. Mershon has specifically stated that the lingual removable alignment wire suggested by him should be constructed of a high-grade spring gold. When the appliance is constructed from this material, the results accomplished are very satisfactory. However, we know of a number of men who have attempted to use removable lingual alignment wire and have attempted to construct it from other materials than those recommended by Dr. Mershon with the result that the use of the appliance has not been satisfactory. If you consider the physical property of the appliance, the manner in which it is constructed, it should be apparent to any one that the only material that will accomplish the desired result is a high-grade spring gold which will possess the elasticity to exert the required force on the malposed teeth.

Some men who have used the removable lingual alignment wire constructed of spring gold have also attempted to make the fixed alignment wire of the

same material, using the wire-stretching pliers to exert the force. It has been proved by various experiments that spring gold is not a suitable material to use in conjunction with the wire-stretching pliers. Any material that is used with the wire-stretching pliers should be a material that possesses very little elasticity and one that possesses considerable strength and rigidity, and still a reasonable amount of softness to enable it to be pinched by the wire-stretching pliers. The only metal that possesses these qualities is iridioplatinum, which a great many men have attempted to avoid using, owing to the high price at the present time. However, we would caution those who desire to use the wire-stretching pliers to leave them alone, or use them only on iridioplatinum, which is the only material that possesses the proper requirements for their successful use. There are some alloys of German silver which more nearly approach the quality of iridioplatinum than anything we have found, but the difficulty with the alloys of German silver is that they may be rendered too soft during the process of soldering.

With the use of the labial arch and the finger spring or with the use of a finger spring on a lingual alignment wire, it necessarily follows that the finger spring must be constructed of spring gold with a large amount of elasticity and with a large amount of strength which will enable the spring gold to be used of the necessary small gauge. The use of any other material for finger springs besides the high elastic spring gold is going to result in failure because no other metal possesses the required spring necessary. In using finger springs, either straight or with the J-extension for the purpose of rotating teeth in conjunction with the bands and tubes, we would again caution all who attempt to use this appliance that, if the finger spring is to be satisfactory, it must be constructed of the proper material. For the construction of the concealed labial arch, which should be used in conjunction with the finger spring, it must be remembered that the elasticity of that appliance is confined principally to the finger spring and, therefore, the labial arch or alignment wire does not necessarily have to possess a high degree of elasticity. In fact, unless there is a particularly good reason why the labial alignment wire used with the finger spring should have an elasticity, it is preferable to use a metal which is more rigid and which is more liable to keep its shape and avoid displacement of the molar anchorage than would be a high elastic labial alignment wire. We realize that if the labial alignment wire is to be used as an active moving appliance for the expansion of the molars or other parts of the dental arch, then an elastic metal should be used. However, we would caution all who use this appliance to remember that the greatest amount of elasticity and the greatest amount of tooth movement is to be accomplished by the finger spring, and the alignment wire is simply a base which holds the finger spring in position while it exerts force on the malposed teeth. Owing to the unsatisfactory results we have seen when men attempted to use these styles of appliances constructed of metal which was contraindicated, we caution all to consider properly the properties of their appliance and the selection of the metal to see whether it is suitable to accomplish the purpose they desire before they attempt to make the appliance.

The little time spent in the careful consideration of metals will very often lead to much more satisfactory results, or, in some cases, eliminate failure entirely.

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ORIGINAL ARTICLES

THE FUNCTION OF TOOTH FORM

BY MARTIN DEWEY, M.D., D.D.S., CHICAGO

IN making a study of the various forms of the teeth as found in man and lower animals, we can not help but be impressed that the form of the tooth has had a definite relation to the function. We may go so far as to say that a tooth performs a certain function because it has assumed a certain form. The importance of the function of the tooth as related to its shape is so great that we find the very nature of animals has been forced to conform to a food made suitable by the shape of a tooth. In the evolution of the dental apparatus, as various forms of teeth have made their appearance, it has been necessary for the animals to adopt a class of food which can be utilized by that tooth, or the animal became an extinct species. It is a well-known fact that the early forms of teeth were simply conical teeth, some of which were long cones, others short and flat. Even in the dental apparatus which was characterized by conical teeth, we find the shape of the tooth or the cone has had a decided bearing upon the nature of the animal. Taking the carnivorous fishes of which Fig. 1 is an illustration, you will note first the long, sharp, conical teeth located on the mandible which are for the purpose of prehension. These teeth have performed this particular function because they were particularly shaped for the purpose. In considering Fig. 2 one will notice that the teeth which are located on the palate and vomer are also long and conical, but have taken a slightly different shape and occupy a different position on the vomer and palate. As a result of this, the teeth in the upper jaw are not prehensile teeth, but are used entirely for deglutition, and consequently the only function which they perform is to assist the animal in swallowing food. In this case we find conical teeth which have the same general form, but which are slightly different, and as a result of that slight difference, perform different functions. As the conical tooth has been modified from the long, slender tooth which performs the functions of prehen-

sion and deglutition, to the flat tooth shown in Fig. 3, which performs the function of crushing, we can readily see how the form of the tooth has influenced its function. The form of the tooth has changed the entire nature of the animal

Fig. 1.—Radiograph of head of Pickerel, showing acrodont ankylosis. (By Dr. E. H. Skinner.)

Fig. 2.—Teeth of Pickerel (*Esox lucius*), showing teeth on vomer and palates.

and such an animal as is shown in Fig. 3, which is a myliobatis, could not utilize the same class of food as the fish shown in Figs. 1 and 2.

Fig. 4 shows another form of the tooth which performs, necessarily, a different function. In this specimen, we see the erupting rows of teeth superim-

posed one upon the other in such a manner as to form a cutting edge. These teeth are a continuous succession, nevertheless, they make their appearance in such a manner as to form a cutting apparatus and consequently the entire dental apparatus forms an organ of incision. The function of these teeth is con-

Fig. 3.—Myliobatis, showing crushing teeth.

Fig. 4.—Roentgenograms of jaws of Parrot-fish (*Scaridæ*), showing incision by rows of teeth. (By Dr. E. H. Skinner.)

Fig. 5.—Roentgenogram of jaw of Woodchuck (*Arctomys monax*), showing long incisor and attachment of same. (By Dr. E. H. Skinner.)

trolled entirely by the form and arrangement, and any other use of these teeth would be absolutely impossible. In Fig. 5 we have the function of incision performed by a single tooth which is so shaped as to make that particular function possible and very efficient. The incisors of the rodent, of which Fig. 5 is a specimen, not only are shaped in such a manner as to perform a function of

incision, but the dental tissues are arranged so as to make the act of incision more efficient than it would be if arranged in the usual manner. The enamel is much thicker on the labial side of the tooth than it is on the lingual side, as a result of which the lingual side wears down more rapidly and the labio-incisal edge always presents a keen cutting edge. The tooth is also of continuous growth, developing from a persistent germ, which makes it necessary that there be some means of protecting the germ against the stress of mastication during the act of incision. It will be observed that the tooth is an arc of a circle and the greatest amount of stress falls on the incisal edge, which displaces the tooth downward, resulting in the tooth being supported by the attachment to the peridental membrane, and the heavy buttress of bone which is seen on the lingual side of the tooth. This downward pressure on the incisal edge of the tooth supported by the alveolar process and peridental membrane on the inciso-lingual border will have a tendency to raise the apical portion of the tooth occlusally, which in turn is held in position by attachment of fibers of the peridental mem-

Fig. 6.—Teeth of Kangaroo (*Macropus giganteus*).

Fig. 7.—Teeth of Mountain Lion. Front view.

brane at the distal portion of the tooth. In fact, the entire shape of the tooth not only gives it a particular function, but it is so shaped as to give it a proper support and consequently increase its efficiency.

The teeth in the anterior portion of the mouth which are known as incisors have been developed for the purpose of cutting, but we find a large number of varieties have developed and all of them have necessarily been used in a different manner to perform the act of incision. Fig. 6 shows the incisors of the kangaroo which are very efficient and which get their particular efficiency from the peculiar form and shape of the tooth. Of the upper incisors we have six, three on each side; of the lowers only two, one on each side. The lower incisors grow directly outward and are so shaped that the mesial surfaces assume the form of scissor blades. As the result of the incisors being so shaped, the mandible has a special movement which makes possible the use of these teeth for cutting off grass. This makes a dental apparatus so highly efficient that the kangaroo is able to live in regions where other herbivorous animals would starve to death. In Fig. 7 we have an illustration of a mountain lion

which shows incisors that have fallen from their original use and function. The incisors of the lion are very greatly degenerated because of their shape. In fact, so far as being organs of incision, they are practically useless, and have taken on the function of bone-scrapers instead of incisors. Associated with them we find the large canines which were originally teeth of prehension, but which have taken on such a size that they have become weapons of warfare, and consequently are used by the animal to secure its food by physical combat. The importance of the large canines as weapons of warfare is clearly emphasized by the strong manner in which they are embedded in the maxilla and mandible. They are sufficiently large as to indicate the characteristics of the animal. As these animals are meat eaters, a highly effective incisal apparatus is necessary, which has been developed from the molars and premolars, as can be seen in Fig. 8. In the carnivora the function of incision has been usurped by the posterior teeth which have developed into cutting teeth which are very effective

Fig. 8.—Teeth of Mountain Lion. Occlusal view, showing arrangement of premolars and molars to perform incision.

and which perform all the functions intended to be performed by the incisors. In fact, with a tooth so formed as shown in Fig. 8, it would be absolutely impossible for it to perform any other function than that of incision. So, here again, we see the shape of the tooth most completely and definitely influencing its function, in fact, controlling practically the entire nature of the animal.

In calling attention to the molars and premolars of the mountain lion I wish to impress the importance of the cusp relation. It will be seen that with the long canine a horizontal or lateral movement of the mandible is impossible, a vertical movement being all that can occur. The long cusps of the molars and premolars also hold the teeth in position and, consequently, there is very small approximal contact. Not only is the development of the cusp important as regards the tooth, but in this case it is important in holding the tooth in the proper position in the dental arch so it can perform its function. We find

that a slight modification of the shape of the tooth will not only influence the function of that tooth, but will influence the entire nature of the animal.

Fig. 9 is the dental apparatus of the hyena in which the canines have become reduced in length as compared to the mountain lion. The cusps of the molars and premolars are short and heavy. As the result of this, the hyena has assumed a diet in which the teeth perform the function of bone crushers, and the bone supporting the teeth has become heavy and dense. Here is shown a decided example of the form of the tooth controlling the function of

Fig. 9.—Teeth of *Hyena crocuta.* Premolars and molars used for crushing.

Fig. 10.—Occlusal view of teeth of Antelope (species unknown). Premolars and molars used for grinding.

the tooth and also controlling the food habits and nature of the animal. In passing from the mountain lion to the hyena we have an example of the importance of the development of the canine as related to the nature of the animal, and we find that is true in practically all animals. In passing to the herbivorous animals that do not develop the canines, we find the nature of the animal has changed so far as physical warfare is concerned, and likewise the

food habits have changed. Owing to the shape of the teeth of the herbivorous animals, they have been forced to assume a different diet; and also owing to the change in their teeth, they have been forced to assume a different means of protecting themselves.

Fig. 10 shows the occlusal view of the dental apparatus of an antelope.

Fig. 11.—Roentgenogram of mandible of a young horse, showing proximal contact of the teeth. (By Dr. E. H. Skinner.)

Fig. 12.—Roentgenogram of mandible of an old horse, showing how the proximal contact has been maintained as the teeth were worn down. (By Dr. E. H. Skinner.)

There are no canines present in either the upper or lower arch, and the incisors are developed only in the mandible. The molars and premolars are wide and flat, the occlusal surfaces of which are thrown up into regular folds and grooves, the cusps being short as compared to the carnivorous tooth, but the proximal

contact is very large and firmly supports the tooth. It is the proximal contact of the upper and lower teeth which holds them in a definite position. The teeth are so shaped that the mesio-buccal angle of the maxillary tooth projects slightly beyond the disto-buccal angle of the tooth in front of it. On the mandibular teeth you will find the proximal contacts are just reversed and the disto-lingual angle of the anterior tooth projects to the lingual of the mesio-lingual angle of the tooth posterior to it. As a result of this arrangement the maxillary and mandibular teeth are supported against the stress of mastication which is brought to bear upon them during the lateral movement of the mandible. You will also notice that the shape of the tooth is such as to make a lateral movement of the mandible possible because the buccal surfaces of the maxillary molars are more occlusal than are the lingual surfaces, and the lingual surfaces of the lower molars are more occlusal than the buccal surfaces. This gives two inclined planes or slopes to the upper and lower teeth, one opposite the other but so arranged as to make a beautifully occlusal contact when the teeth are in occlusion. The various forms of the teeth are such as to render mastication highly efficient for the particular kind of food which the animal utilizes. The importance of the proximal contact for holding the teeth in position as related to the form of the tooth can be understood by studying Fig. 11, which is a radiogram of the jaws of a young horse. It will be seen how beautifully the teeth are approximated and how the first and second permanent molars are developing behind the deciduous molars, each one taking a beautiful proximal contact which is necessary to hold the tooth in proper position. We find the function of these teeth as related to form is very important because the teeth are of continuous eruption, the length of the crown greatly exceeding the length of the root. As the animal grows older and the crown is worn away, the tooth continues to erupt. As the crown is worn down, it necessarily follows that a smaller mesio-distal diameter of the tooth will finally occupy the occlusal plane, which makes it necessary for the entire dental apparatus to change in order that the proximal contact be maintained.

Fig. 12 shows a radiograph of an old horse, twenty-seven years of age, in which the teeth have been greatly worn down occlusally, with the result that they have continued to erupt and a narrower mesio-distal diameter of the tooth has been brought together. As this change occurred in the mesio-distal diameter of the teeth, the anterior teeth were forced to drift distally and the posterior teeth drifted mesially and in this manner the proximal contacts were maintained. This shows the importance of the tooth form and the proximal contact of the teeth as means of supporting them in the dental apparatus so they can perform their functions.

As we take up the study of the human teeth in the relation of the form to the function, we find that the form of the tooth as related to its function is more important than has been realized by a large number of practitioners. The teeth of man are divided into four groups: the incisors, canines, premolars and molars. We will only take up the consideration of one tooth of each group, and call attention to some chief forms and the functions which they perform in the masticating apparatus.

In considering the incisors of man, one of the first important functions as

related to tooth form is the function of the linguo- and labio-gingival marginal ridge. Fig. 13 shows that the labial surface of the incisor has the greatest amount of convexity at the gingival border, or the gingival third. This gingival convexity is for the purpose of protecting the gingival gum tissue, but is not so well developed as it is on the lingual side, because it does not have as important a function to perform. In the act of incision, the food slides along the lingual surface of the upper incisor until it comes to the point corresponding to the lingual fossa, at which place it is deflected backward or toward the

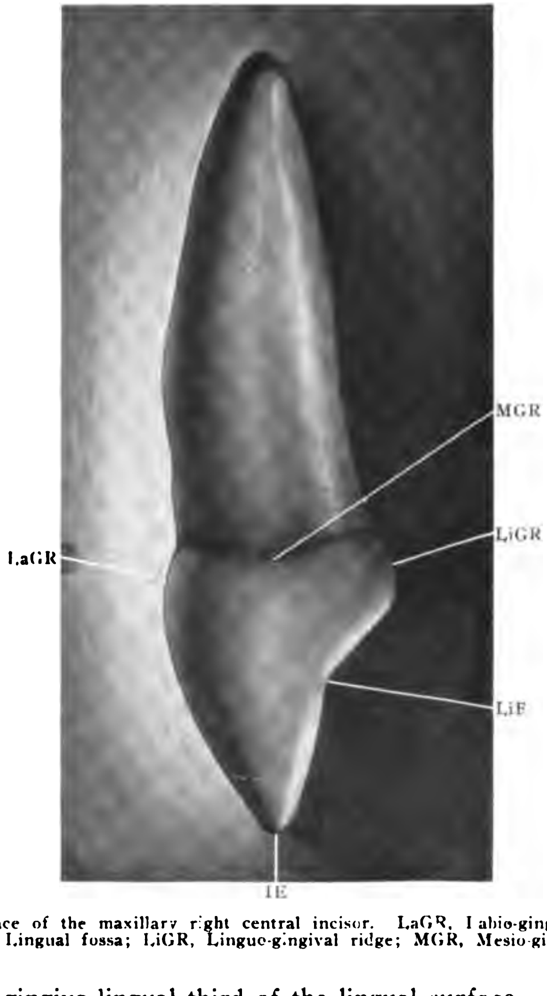


Fig. 13.—Mesial surface of the maxillary right central incisor. LaGR, Labio-gingival ridge; IE, Incisal edge; LiF, Lingual fossa; LiGR, Linguo-gingival ridge; MGR, Mesio-gingival ridge.

palate along the gingivo-lingual third of the lingual surface. At this point is a development of the linguo-gingival ridge that deflects the food away from the soft gingival tissue, which proves the function of the linguo-gingival ridge of the incisor is to protect the gingival tissues. However, we find the majority of artificial crowns are constructed without any attempt to restore the linguo-gingival ridge, with the result that after a crown has been placed upon the root; we very often observe that the gingival tissue recedes and the root becomes exposed. The shape of the crown is such that it does not protect the

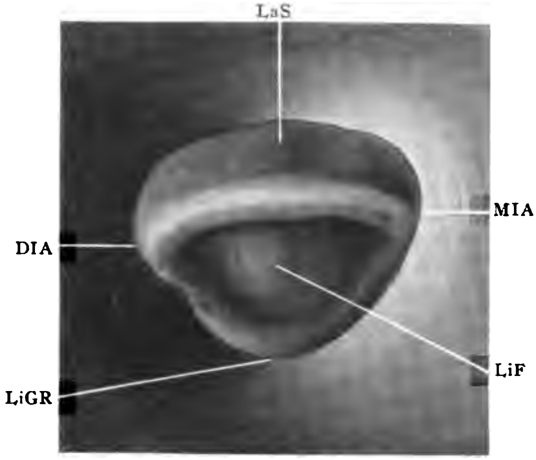


Fig. 14.—Incisal surface of the maxillary right central incisor. DIA, Disto-incisal angle; LiGR, Linguo-gingival ridge; LiF, Lingual fossa; MIA, Mesio-incisal angle; LaS, Labial surface.

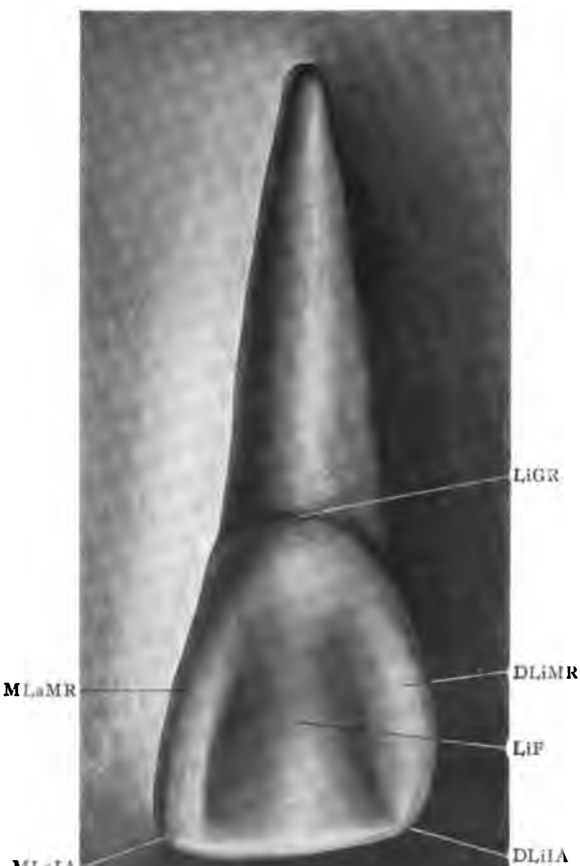


Fig. 15.—Lingual surface of the maxillary right central incisor. MLaMR, Mesio-labial marginal ridge; MLaIA, Mesio-labio-incisal angle; DLiIA, Disto-linguo-incisal angle; LiF, Lingual fossa; DLiMR, Disto-lingual marginal ridge; LiGR, Linguo-gingival ridge.

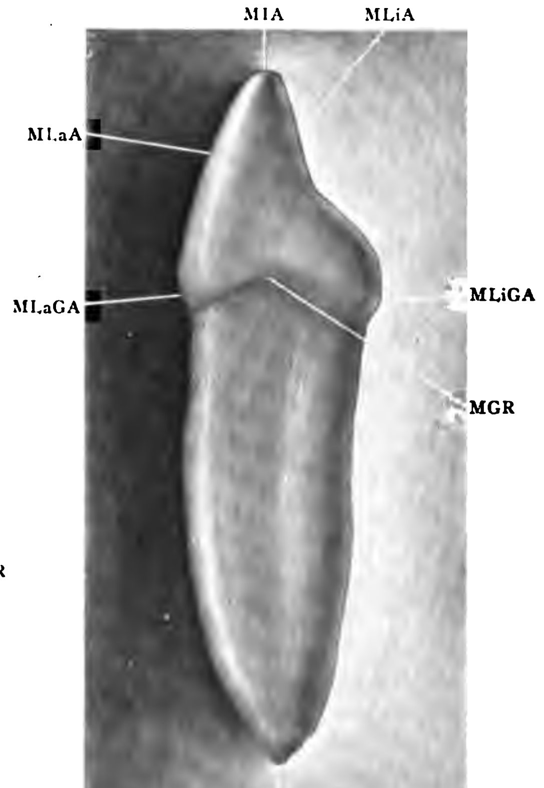


Fig. 16.—Mesial surface of the mandibular right lateral incisor. MLaA, Mesio-labial line angle; MLaGA, Mesio-labio-gingival angle; A, Apex of root; MGR, Mesio-gingival ridge; MLiGA, Mesio-linguo-gingival angle; MLiA, Mesio-lingual line angle; MIA, Mesio-incisal angle.

soft tissue, and consequently the soft tissue is crowded away from the root by the food during mastication.

Fig. 14 shows the incisal view of an upper central incisor which has been made by looking directly on the incisal edge of the tooth. The incisal edge is slightly nearer the labial than it is near the lingual, which allows for a large lingual slope extending from the incisal edge to the linguo-gingival ridge. You will also observe that there is a linguo-gingival ridge extending toward the linguo-gingival marginal ridge which is for the purpose of guiding the food toward the center of the tooth and keeping it away from the proximal embrasures of the teeth. The proximal surfaces of the tooth have contact points so arranged as to keep food from wedging in between the teeth. The proximal contact is very important and the shape is always such as to guide the food away from the proximal embrasures either into the oral cavity or out toward the lip where it can be returned to the teeth for further mastication.

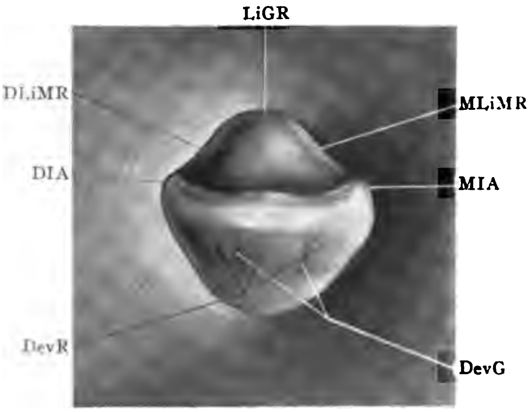


Fig. 17.—Incisal view of the mandibular lateral incisor. DLiMR, Disto-lingual marginal ridge; DIA, Disto-incisal angle; DevR, Developmental ridges; DevG, Developmental grooves; MIA, Mesio-incisal angle; MLiMR, Mesio-lingual marginal ridge; LiGR, Linguo-gingival ridge.

Fig. 15 shows a surface view of the maxillary central and shows the importance of the form of the lingual which also has to deal with the food being guided into the oral cavity. It will be observed that the proximal contact of the mesial side is nearer the occlusal surface than is the proximal contact of the distal side. While this may not be so important as regards function, nevertheless it is important when one considers the fact that the maxillary lateral incisor is a smaller tooth than the central and the mesial contact of the maxillary lateral proximates with the distal surface of the central.

We see a large number of beautiful restorations from the standpoint of mechanics, some are gold-foil fillings, others are inlays of gold or porcelain, which are made with the mesial and distal sides exactly the same. The operators had failed to realize the importance of tooth form from a functional and artistic standpoint.

Mandibular incisors of man present very nearly the same outline as regards function in relation to form as do the maxillary incisors. Fig. 16 is a view of the mandibular central incisor which shows the same labio-gingival ridge that there is on the maxillary incisor.

Fig. 17 shows the incisal edge of the mandibular central is near the center

of the tooth, which means there is a greater slope of the labial surface gingivally than there is in the maxillary incisor. The mesial and distal proximal contacts are so shaped as to deflect the food away from between the teeth and more toward the oral cavity than toward the cheeks. When we study the canine, we find a tooth in man, which to a certain extent, has lost its original function. The canines primarily were teeth designed for prehension, but in man the act of prehension has been usurped to a certain extent by the fingers, and the teeth are not used for prehension as they are in the lower animals. While the canine

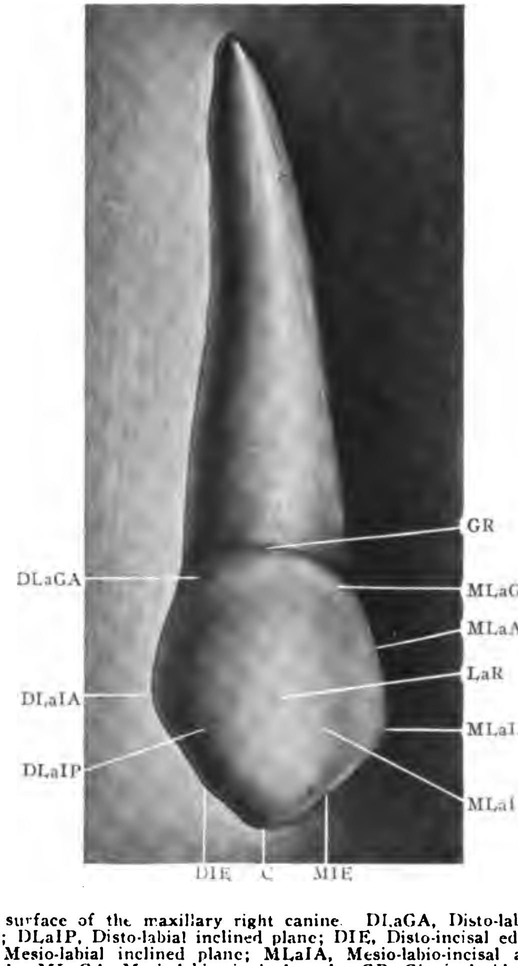


Fig. 18.—Labial surface of the maxillary right canine. DLaGA, Disto-labio-gingival angle; DLaIA, Disto-labio-incisal angle; DLaIP, Disto-labial inclined plane; DIE, Disto-incisal edge; C, Cusp; MIE, Mesio-incisal edge; MLaIP, Mesio-labial inclined plane; MLaIA, Mesio-labio-incisal angle; LaR, Labial ridge; MLaA, Mesio-labial angle; MLaGA, Mesio-labio-gingival angle; GR, Gingival ridge.

has lost a certain amount of its original function, it still presents a form which is very interesting, both as regards the remaining functions of the tooth and the esthetic value of the tooth form. There probably is no tooth in the mouth as difficult to reproduce as the maxillary canine if we consider the original function of the tooth form as well as the importance which the tooth bears from the esthetic standpoint. It has been evolved from an original conical tooth, but in being made to occupy the position which it holds in the human mouth,

various sides and angles have required a change which is different from that found in other animals.

In looking at the labial surface of the crown as shown in Fig. 18 you will observe that it presents five point angles which are the mesio-gingival, the mesio-incisal, the incisal, the disto-incisal and the disto-gingival. These five point angles on the labial surface are all different and the differences in shape must be maintained if we are to have the proper function and beauty of the tooth. The central developmental lobe of the canine is especially well formed which results in a large amount of convexity of the labial surface both mesio-distally

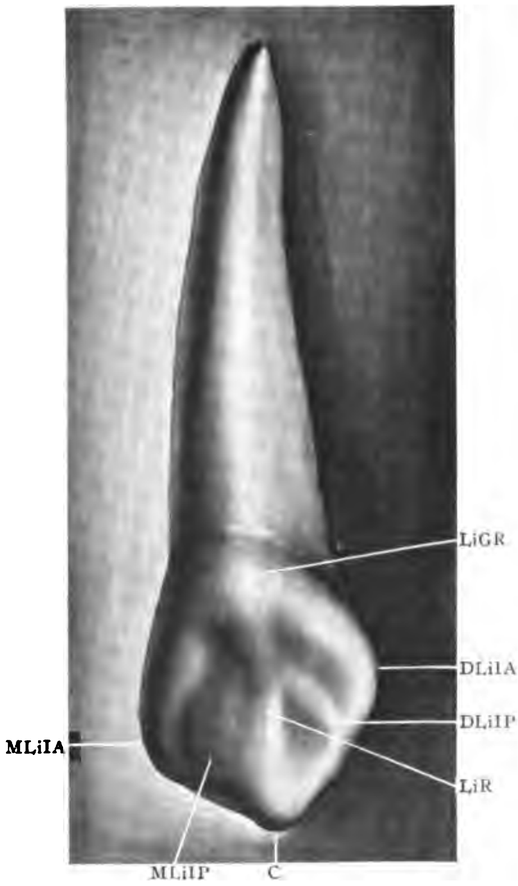


Fig. 19.—Lingual surface of the maxillary right canine. MLiIA, Mesio-linguo-incisal angle; MLiIP, Mesio-linguo-inclined plane; C, Cusp; LiR, Lingual ridge; DLiIP, Disto-lingual inclined plane; DLiIA, Disto-linguo-incisal angle; LiGR, Linguo-gingival ridge.

and bucco-lingually. The mesio-incisal angle of the labial surface is nearer the occlusal border than the disto-incisal angle of the labial surface. As a result of this the line angle extending from the mesio-incisal angle to the cusp is shorter than the line angle extending from the disto-incisal angle to the cusp. This gives a five-pointed labial surface, all points of which are different, and all of which are made by different lengths of line angles.

Fig. 19 shows the lingual surface of the maxillary canine, and one of the

first points to which our attention is directed is the extensive development of the linguo-gingival ridge, as well as the mesial and disto-lingual marginal ridges. There is a tendency for the lingual ridge to extend from the cusp of the tooth toward the linguo-gingival ridge, which may be marked by a fossa on both sides of the ridge, or which may be crossed by a lingual fossa, or which may be absent owing to the extensive development of the linguo-gingival ridge into a tubercle. However, it will be observed that the mesio- and disto-lingual marginal ridges are so shaped as to guide the food towards the central portion

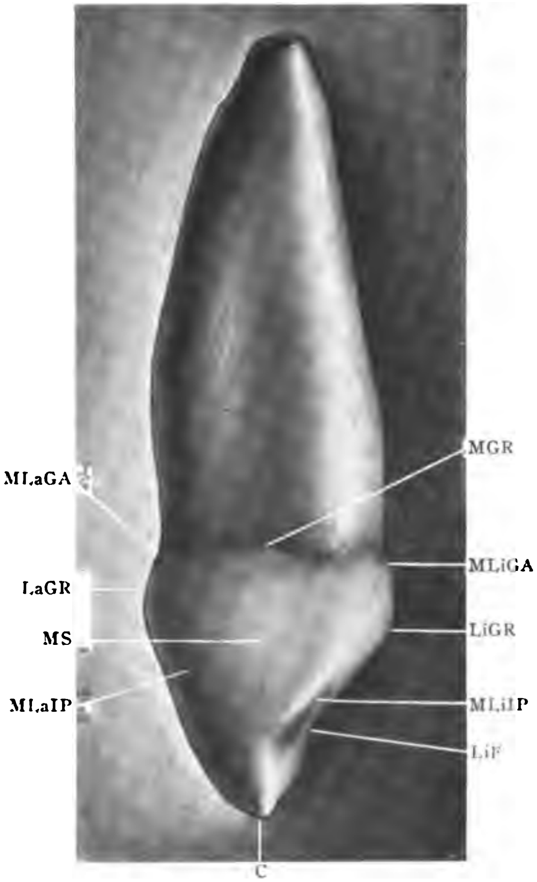


Fig. 20.—Mesial surface of the maxillary right canine. MLaGA, Mesio-labio-gingival angle; LaGR, Labio-gingival ridge; MS, Mesial surface; MLaIP, Mesio-labial inclined plane; C, Cusp; LiF, Lingual fossa; MLiIP, Mesio-lingual inclined plane; LiGR, Linguo-gingival ridge; MLiGA, Mesio-linguo-gingival angle; MGR, Mesio-gingival ridge.

of the tooth and the linguo-gingival ridge is so extensively developed as to guide the food away from the gingival gum tissue.

Fig. 20 shows the mesial surface of the maxillary canine which will give some idea of the manner in which the labial and lingual surfaces converge towards the cusp. It will also be seen than the linguo-gingival ridge on the labial and lingual side of the tooth is well developed and prevents the food from impinging on the gingival tissue. Owing to the excessive development of the mesial and distal proximal contacts, it will be seen that the crown of the tooth

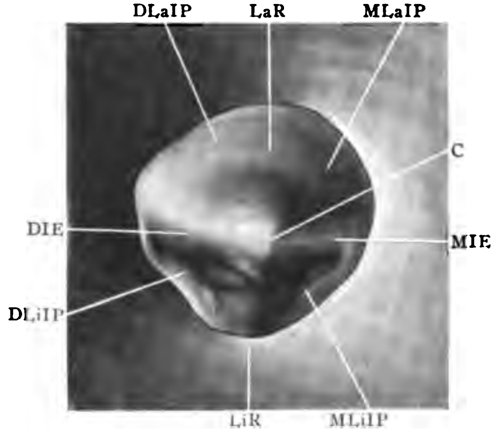


Fig. 21.—Incisal view of the maxillary right canine. DIE, Disto-incisal edge; DLiIP, Disto-lingual inclined plane; LiR, Lingual ridge; MLiIP, Mesio-lingual inclined plane; MIE, Mesio-incisal edge; C, Cusp; MLaIP, Mesio-labial inclined plane; LaR, Labial ridge; DLaIP, Disto-labial inclined plane.

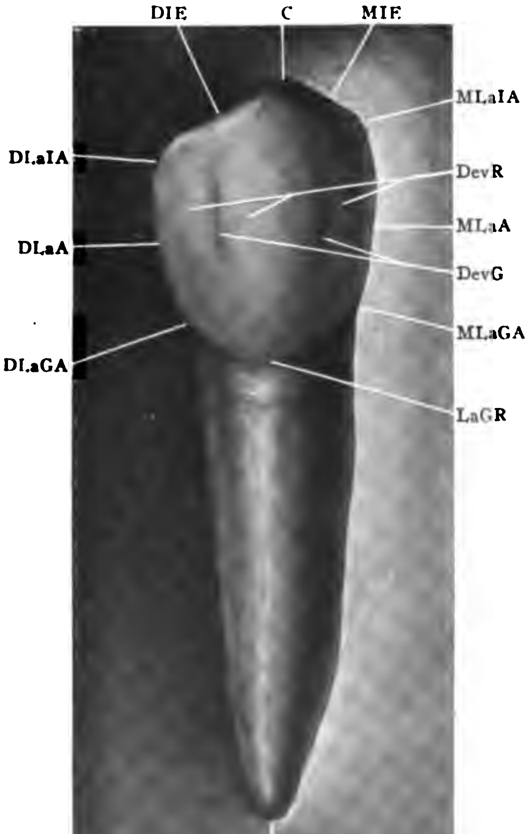


Fig. 22.—Labial surface of the mandibular right canine. DLaIA, Disto-labio-incisal angle; DLaA, Disto-labial line angle; DLaGA, Disto-labio-gingival angle; A, Apex of root; LaGR, Labio-gingival ridge; MLaGA, Mesio-labio-gingival angle; DevG, Developmental grooves; MLaA, Mesio-labial line angle; DevR, Developmental ridges; MLaIA, Mesio-labio-incisal angle; MIE, Mesio-incisal edge; C, Cusp; DIE, Disto-incisal edge.

is much wider through the proximal contacts than it is at the gingival border. This is produced by the mesial and distal surfaces of the upper canine converging towards each other lingually as well as gingivally, which makes the labial surface of the crown much wider than the lingual surface at the gingival border. This is a very important form owing to the position it occupies in the corner of the mouth, and also in regard to the deflecting of food away from the soft tissues during mastication. In making restorations of the upper canine there is a great tendency to fail to restore the gingival marginal ridges, and consequently there probably is no tooth that is crowned in which the

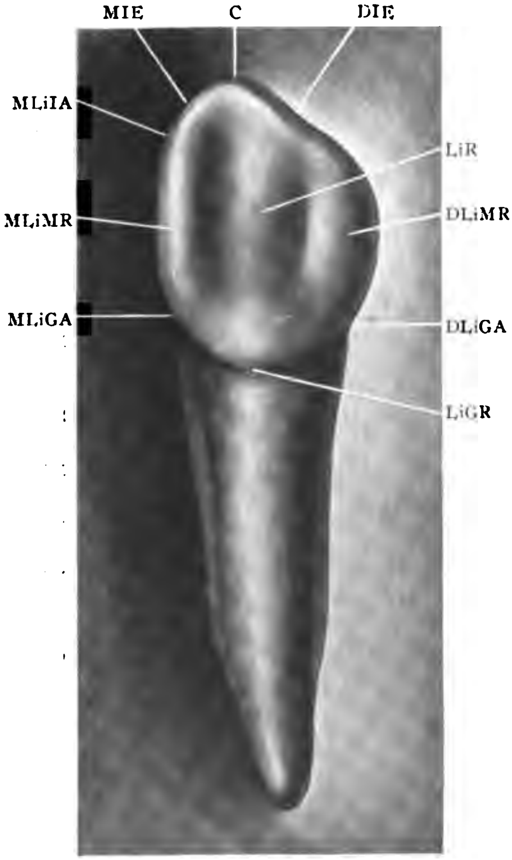


Fig. 23.—Lingual surface of the mandibular right canine. MLiIA, Mesio-linguo-incisal angle; MLiMR, Mesio-lingual marginal ridge; MLiGA, Mesio-linguo-gingival angle; LiGR, Linguo-gingival ridge; DLiGA, Disto-linguo-gingival angle; DLiMR, Disto-linguo-marginal ridge; LiR, Lingual ridge; DIE, Disto-incisal edge; C, Cusp; MIE, Mesio-incisal edge.

gum recedes as often as it does in the maxillary canine. Restorations involving the mesial and distal surfaces of the maxillary canine are difficult to make owing to the excessive development of the proximal contact points and the peculiar angle at which the surfaces join each other. In looking at the occlusal or incisal view of a maxillary canine (Fig. 21) it will be seen that the cusp of the tooth is slightly more toward the mesial than to the distal, and that the labial surface presents an even convexity in all directions. It will be seen that the lingual fossa of the canine is not so well developed as the lingual

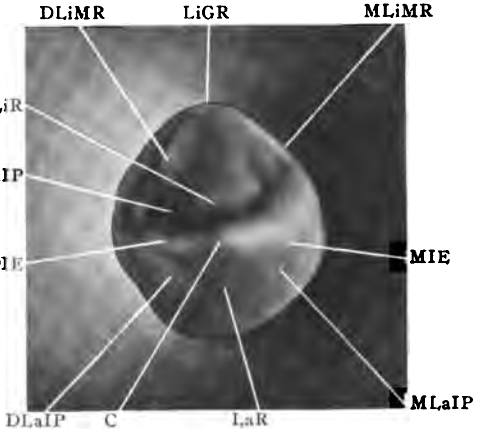


Fig. 24.—Incisal view of the right mandibular canine. LiR, Lingual ridge; DLiIP, Disto-lingual inclined plane; DIE, Disto-incisal edge; DLaIP, Disto-labial inclined plane; C, Cusp; LaR, Labial ridge; MLaIP, Mesio-labial inclined plane; MIE, Mesio-incisal edge; MLiMR, Mesio-lingual marginal ridge; LiGR, Linguo-gingival ridge; DLiMR, Disto lingual marginal ridge.

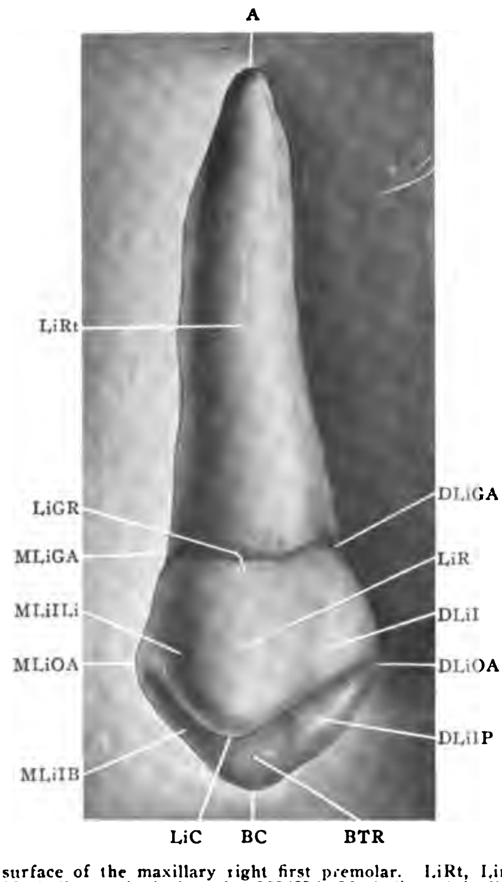


Fig. 25.—Lingual surface of the maxillary right first premolar. LiRt, Lingual root; LiGR, Linguo-gingival ridge; MLiGA, Mesio-linguo-gingival angle; MLiILi, Mesio-lingual inclined plane of lingual cusp; MLiOA, Mesio-linguo-occlusal angle; MLiIB, Mesio-lingual inclined plane of buccal cusp; LiC, Lingual cusp; BC, Buccal cusp; BTR, Bucco-triangular ridge; DLiIP, Disto-linguo-inclined plane of buccal cusp; DLiOA, Disto-linguo-occlusal angle; DLiI, Disto-lingual incline of lingual cusp; LiR, Lingual ridge; DLiGA, Disto-linguo-gingival angle; A, Apex of root.

fossa of the incisors, owing to the fact that the lingual ridge extending from the tip of the cusp to the linguo-gingival marginal ridge is, as a rule, very well developed in the upper canine. The form of the mandibular canine is very similar to that of the maxillary canine, with the exception that the mesial surface of the crown and the root is more nearly a straight line. The excessive width of the crown over the root is the result of the development of the convexity of the distal surface, which results in the distal surface of the crown projecting beyond the distal surface of the root much farther than the mesial surface. The tip of the cusp is nearer the mesial surface, and the mesio-incisal edge of the mandibular canine is shaped to occlude with the lingual sur-

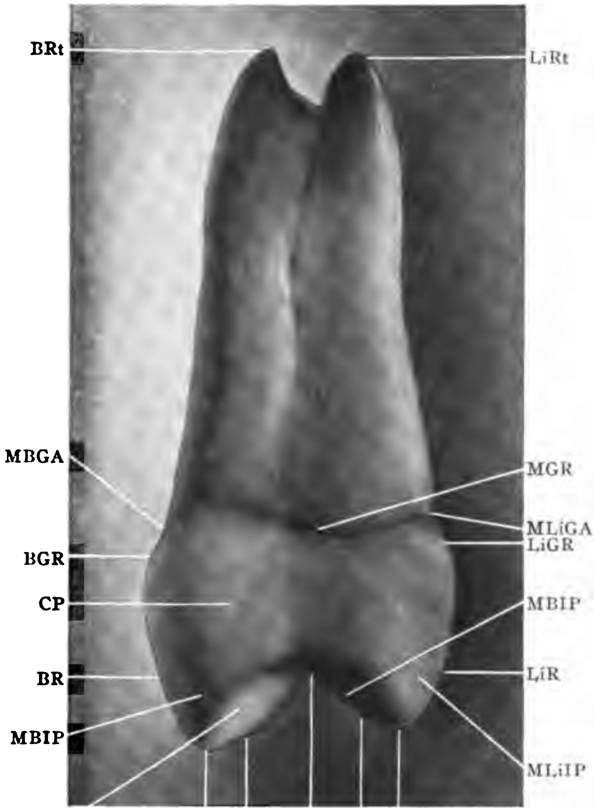


Fig. 26.—Mesial surface of the maxillary right first premolar. BRt, Buccal root; MBGA, Mesio-bucco-gingival angle; BGR, Bucco-gingival ridge; CP, Contact point; BR, Buccal ridge; MBIP, Mesio-buccal inclined plane; MLiIP, Mesio-lingual inclined plane; BC, Buccal cusp; BTR, Buccal triangular ridge; CF, Central fossa; LiTR, Linguo-trianguiar ridge; LiC, Lingual cusp; MLiIP, Mesio-lingual inclined plane; LiR, Lingual ridge; MBIP, Mesio-buccal inclined plane; LiGR, Linguo-gingival ridge; MLiGA, Mesio-linguo-gingival angle; MGR, Mesio-gingival ridge; LiRt, Lingual root.

face of the maxillary lateral incisor. The disto-incisal edge of the mandibular canine occludes with the mesio-linguo-incisal edge of the maxillary canine, and consequently must be so shaped as to fit with that surface. (Fig. 22.)

Fig. 23 shows the lingual surface of the mandibular canine and the greater width of the disto-incisal angle as compared to the mesio-incisal angle. The

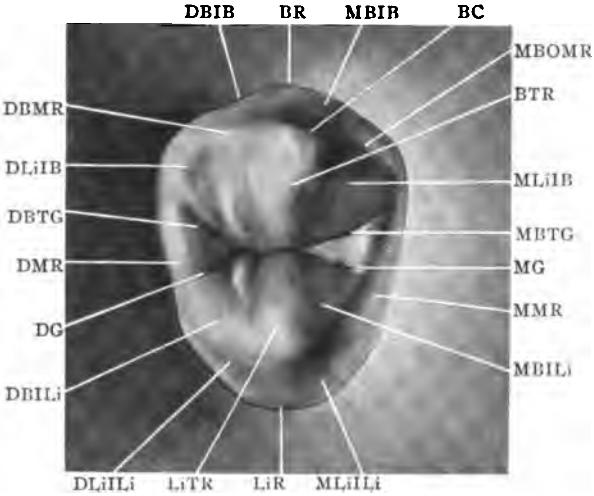


Fig. 27.—Occlusal surface of the maxillary right first premolar. DBMR, Disto-buccal marginal ridge; DLiIB, Disto-lingual inclined plane of buccal cusp; DBTG, Disto-bucco-triangular groove; DMR, Distal marginal ridge; DG, Distal groove; DBILi, Disto-buccal inclined plane of lingual cusp; DLiILi, Disto-lingual inclined plane of lingual cusp; LiTR, Linguo-triangular ridge; LiR, Lingual ridge; MLiILi, Mesio-lingual inclined plane of lingual cusp; MBILi, Mesio-buccal inclined plane of lingual cusp; MMR, Mesial marginal ridge; MG, Mesial groove; MBTG, Mesio-bucco-triangular groove; MLiIB, Mesio-lingual inclined plane of buccal cusp; BTR, Bucco-triangular ridge; MBOMR, Mesio-bucco-occlusal marginal ridge; BC, Buccal cusp; MBIB, Mesio-buccal inclined plane of buccal cusp; BR, Buccal ridge; DBIB, Disto-buccal inclined plane of buccal cusp.

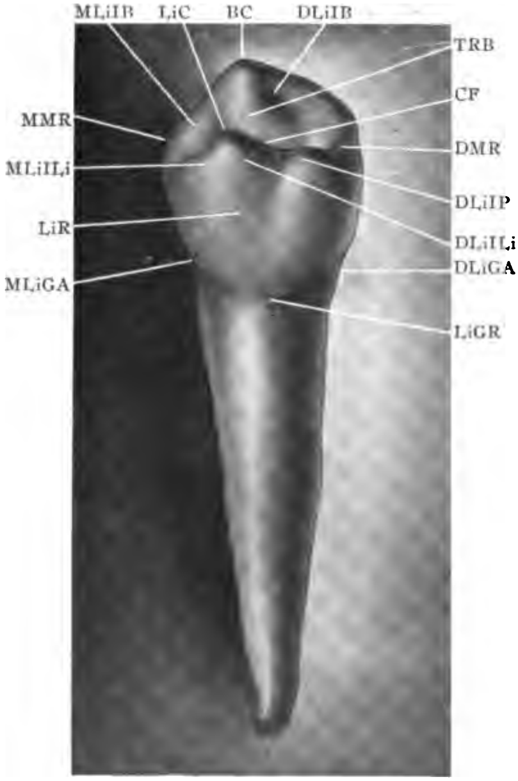


Fig. 28.—Lingual surface of the mandibular right first premolar. MMR, Mesial marginal ridge; MLiILi, Mesio-lingual inclined plane of the lingual cusp; LiR, Lingual ridge; MLiGA, Mesio-linguo-gingival angle; LiGR, Linguo-gingival ridge; DLiGA, Disto-linguo-gingival angle; DLiILi, Disto-lingual inclined plane of lingual cusp; DLiIP, Disto-lingual inclined plane; DMR, Distal marginal ridge; CF, Central fossa; TRB, Triangular ridge of buccal cusp; DLiIB, Disto-lingual inclined plane of buccal cusp; BC, Buccal cusp; LiC, Lingual cusp; MLiIB, Mesio-lingual inclined plane of buccal cusp.

labio- and linguo-gingival marginal ridges are well developed, which can be observed from Figs. 22, 23, and 24. Fig. 24 shows the occlusal view of the tooth. It will be seen that the cusp of the tooth is much nearer the labial surface of the mandibular canine than it is the maxillary canine, and that the lingual border presents a greater slope than the maxillary canine. The extreme slope of the lingual border of the mandibular canine is to allow the food to slide past the lingual border and beyond the gingival gum tissue.

In considering the form of the premolars, we find that they are teeth which have been shaped for mastication; nature having provided them with a wide

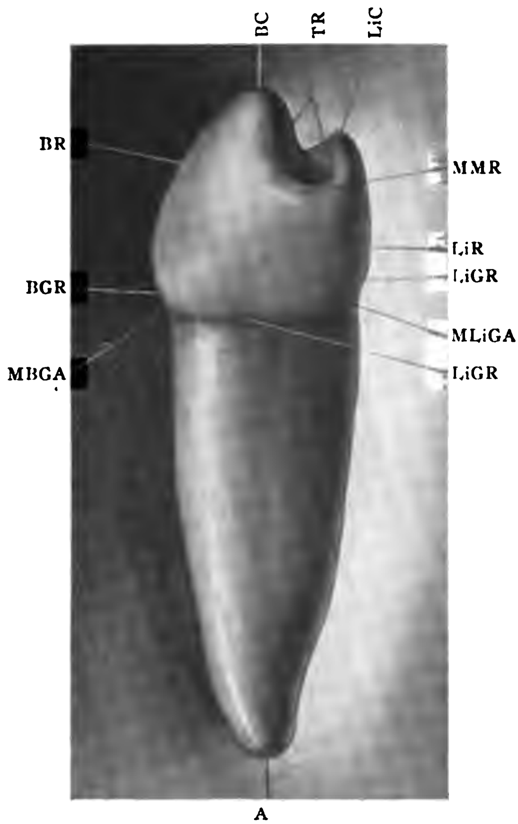


Fig. 29.—Mesial surface of the mandibular right first premolar. BR, Buccal ridge; BGR, Bucco-gingival ridge; MBGA, Mesio-bucco-gingival angle; A, Apex of root; LiGR, Linguo-gingival ridge; MLiGA, Mesio-linguo-gingival angle; LiGR, Linguo-gingival ridge; LiR, Lingual ridge; MMR, Mesial marginal ridge; LiC, Lingual cusp; TR, Triangular ridges; BC, Buccal cusp.

occlusal surface which has not been present in the other teeth considered. As a result of this, one of the most important functions of the tooth form of the premolars is that of mastication, and consequently the occlusal surface should receive much more attention than it has in times past. The mesial and distal proximal contacts of the maxillary first premolar can be accurately seen in Fig. 25, and it will be observed that the contact points are near the occlusal border or near the mesio- and disto-occlusal marginal ridge. It will also be observed by studying Fig. 26 that the buccal cusp appears to be longer than the

lingual cusp, which is true in looking at a tooth from the direct perpendicular axis. However, as the tooth sets in the mouth, the lingual cusp occupies a lower occlusal position than does the buccal cusp; in fact, the lingual cusp is the masticating cusp, having occlusion on four surfaces, while the buccal cusp has occlusion only on the two lingual surfaces. It must be remembered that in the mouth the premolars do not set in a perpendicular position, as they do in this cut, but the crown occupies a much more buccal position than the apex of the root. It will be observed that the gingival marginal ridges of the buccal and lingual surfaces are well developed and that the widest portion of the crown bucco-lingually is to the region of the gingival ridges of the buccal and lingual surfaces. The occlusal surface of the tooth bucco-lingually is much narrower than the gingival portion of the tooth bucco-lingually, resulting in a decided occlusal constriction as compared with the diameter of the crown at the gingival border. This is just exactly the reverse as is found in studying

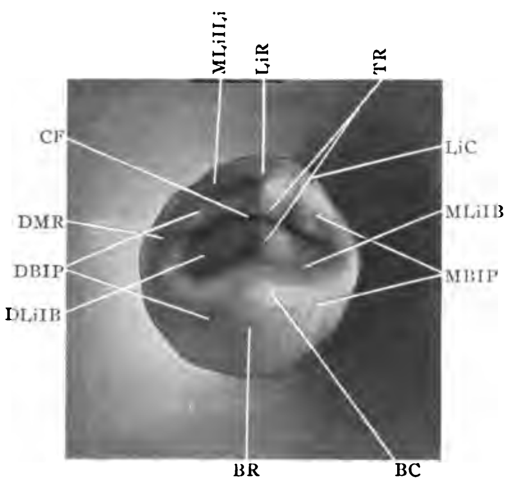


Fig. 30.—Occlusal surface of the mandibular right first premolar. CF, Central fossa; DMR, Distal marginal ridge; DBIP, Disto-buccal inclined planes of buccal and lingual cusps; DLiIB, Disto-lingual inclined plane of buccal cusp; BR, Buccal ridge; BC, Buccal cusp; MBIP, Mesio-buccal inclined planes of buccal and lingual cusps; MLiIB, Mesio-lingual inclined plane of buccal cusp; LiC, Lingual cusp; TR, Triangular ridges; LiR, Lingual ridge; MLiILi, Mesio-lingual inclined plane of lingual cusp.

the mesio-distal diameter of the premolar, because in Fig. 25 you will see the occlusal diameter is much greater than the gingival diameter. This difference in the diameters of the occlusal and gingival portions of the tooth viewed in the two directions, as regards the function, has not been sufficiently appreciated.

Fig. 27 shows the occlusal view of maxillary first premolar which also shows the different diameters mesio-distally and bucco-lingually. It will be observed that the marginal ridges of the buccal and lingual surfaces pass over the buccal and lingual cusps; consequently, if the tooth were measured in that diameter it would be much smaller than if measured through the bucco-linguo-gingival marginal ridge. The mesio- and disto-occlusal marginal ridge occupy positions near the extreme borders of the tooth, and also owing to the development of the proximal contact points the mesial and distal marginal ridges are much farther apart mesio-distally than the mesio- and disto-gingival ridges. As a result of this difference in diameter of the crown the mesial and distal

proximal contact of the premolars are so formed as to make a well-developed interproximal space which is filled with proximal gum tissue. It will also be observed that the triangular ridges of the buccal and lingual cusps slope gingivally towards the central fossa, and running out from the central fossa are the triangular grooves and the mesial and distal marginal grooves which have the function of deflecting the food away from the center of the tooth over the occlusal marginal ridges and into the oral cavity. It will be observed that the mesial and distal grooves extending from the central fossa run towards the lingual surface of the tooth in such a manner that the food passes over the occlusal margin of

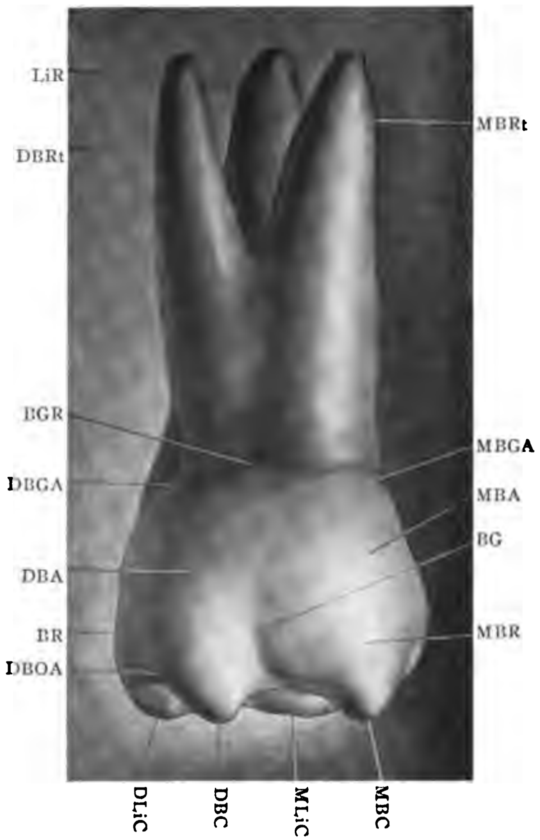


Fig. 31.—Buccal surface of the maxillary right first molar. LiR, Lingual root; DBRt, Disto-buccal root; BGR, Bucco-gingival ridge; DBGA, Disto-bucco-gingival angle; DBA, Disto-buccal angle; BR, Buccal ridge; DBOA, Disto-bucco-occlusal angle; DLiC, Disto-lingual cusp; DBC, Disto-buccal cusp; MLiC, Mesio-lingual cusp; MBC, Mesio-buccal cusp; MBR, Mesio-buccal ridge; BG, Buccal groove; MBA, Mesio-buccal angle; MBGA, Mesio-bucco-gingival angle; MBRt, Mesio-buccal root.

the premolars to the lingual of the proximal contacts and out into the oral cavity and away from the interproximal space. It will also be seen that the form of the occlusal surface of the premolar is marked by three sets of grooves; namely, the central groove, the triangular grooves and the mesio-distal grooves. We also find three ridges running across the occlusal surface of the tooth, which increase the roughness of the occlusal surface and thereby increase the masticating efficiency. Those ridges are the mesial and distal occlusal mar-

ginal ridges and the triangular ridges which form the transverse ridge of the occlusal surface. In speaking of the transverse ridge of the occlusal surface it must be remembered that this is a double ridge formed by the triangular ridges of the buccal and lingual cusps. Owing to the excessive width of the diameter of the tooth bucco-lingually at the gingival border as compared to the same diameter of this tooth at the occlusal border, it will be observed that such food as slides over the buccal and lingual surfaces of the crown of the premolar will be guided away from the gingival tissue owing to the form of the gingival ridge. While the difference in the diameter of the occlusal surface and the gingival margin of the premolar bucco-lingually is apparent to all, this difference in diam-

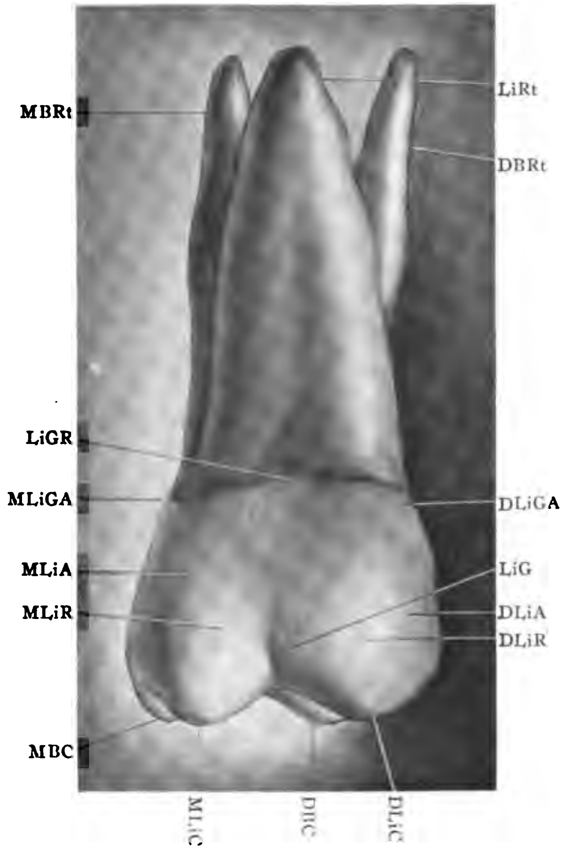


Fig. 32.—Lingual surface of the maxillary right first permanent molar. MBRt, Mesio-buccal root; LiGR, Linguo-gingival ridge; MLiGA, Mesio-linguo-gingival angle; MLiA, Mesio-lingual angle; MLiR, Mesio-lingual ridge; MBC, Mesio-buccal cusp; MLiC, Mesio-lingual cusp; DBC, Disto-buccal cusp; DLiC, Disto-lingual cusp; DLiR, Disto-lingual ridge; DLiA, Disto-lingual angle; LiG, Lingual groove; DLiGA, Disto-linguo-gingival angle; DBRt, Disto-buccal root; LiRt, Lingual root.

eter is not realized by the manufacturers of artificial teeth and is not restored in a large number of restorations made by dentists. I realize that the form of the upper first premolar is very difficult to restore owing to these different diameters at the gingival border and the occlusal border; nevertheless, they must be restored if the tooth is to perform its proper function.

The form of the mandibular first premolar differs very materially from that of the maxillary first premolar, and the function must be carefully con-

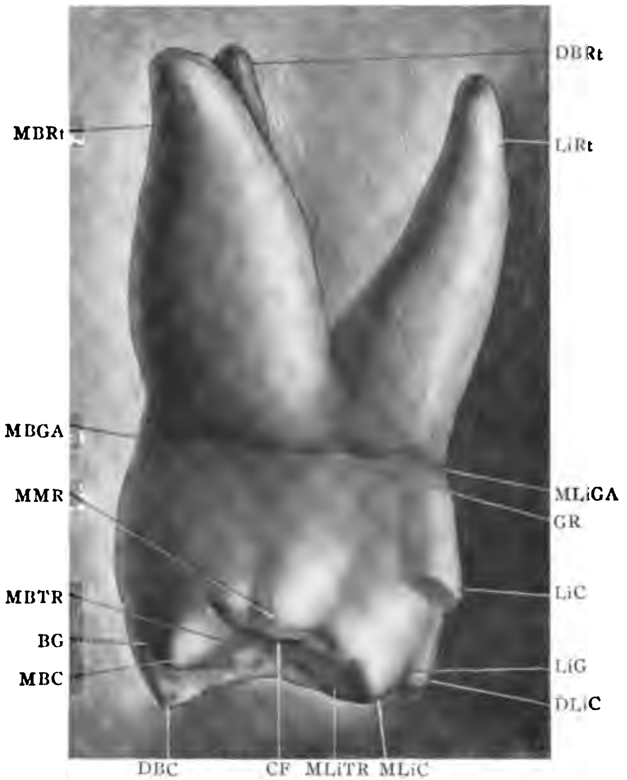


Fig. 33.—Mesial surface of the maxillary right first molar. MBRt, Mesio-buccal root; MBGA, Mesio-bucco-gingival angle; MMR, Mesial marginal ridge; MBTR, Mesio-bucco-triangular ridge; BG, Buccal groove; MBC, Mesio-buccal cusp; DBC, Disto-buccal cusp; CF, Central fossa; MLiTR, Mesio-linguo-triangular ridge; MLiC, Mesio-lingual cusp; DLiC, Disto-lingual cusp; LiG, Lingual groove; LiC, Lingual or fifth cusp; GR, Gingival ridge; MLiGA, Mesio-linguo-gingival angle; LiRt, Lingual root; DBRt, Disto-buccal root.

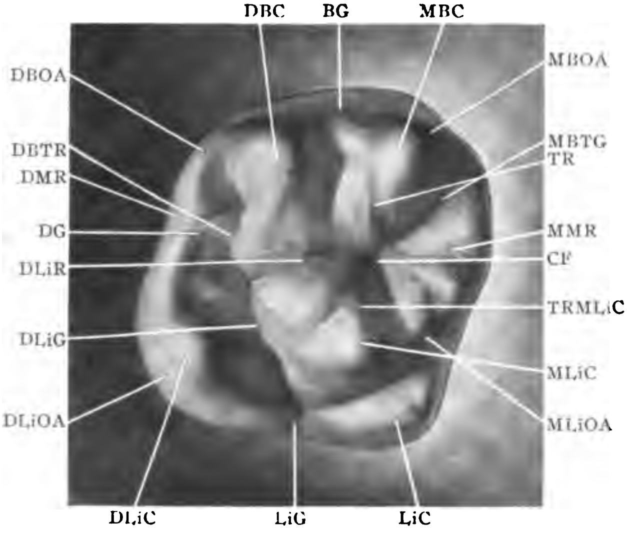


Fig. 34.—Occlusal surface of the maxillary right first molar. DBOA, Disto-bucco-occlusal angle; DBTR, Disto-bucco-triangular ridge; DMR, Distal marginal ridge; DG, Distal groove; DLiR, Disto-lingual ridge; DLiG, Disto-lingual groove; DLiOA, Disto-linguo-occlusal angle; DLiC, Disto-lingual cusp; LiG, Lingual groove; LiC, Lingual or fifth cusp; MLiOA, Mesio-linguo-occlusal angle; MLiC, Mesio-lingual cusp; TRMLiC, Triangular ridge of mesio-lingual cusp; CF, Central fossa; MMR, Mesial marginal ridge; TR, Triangular ridge; MBTG, Mesio-bucco-triangular groove; MBOA, Mesio-bucco-occlusal angle; MBC, Mesio-buccal cusp; BG, Buccal groove; DBC, Disto-buccal cusp.

sidered in relation to that form. It will be remembered that the mandibular first premolar occupies a position in the corner of the mandibular arch at the point of greatest curvature. Fig. 28 shows how the lingual surface of the mandibular first premolar has been shaped to occupy this position in the dental arch, and also shows the extreme development of the buccal cusp as compared to the lingual cusp.

Fig. 29, which shows the mesial surface of the same tooth, gives an idea of the difference in size of the buccal and lingual cusps. It will be observed that the buccal surface of the buccal cusp is a large convex surface with the

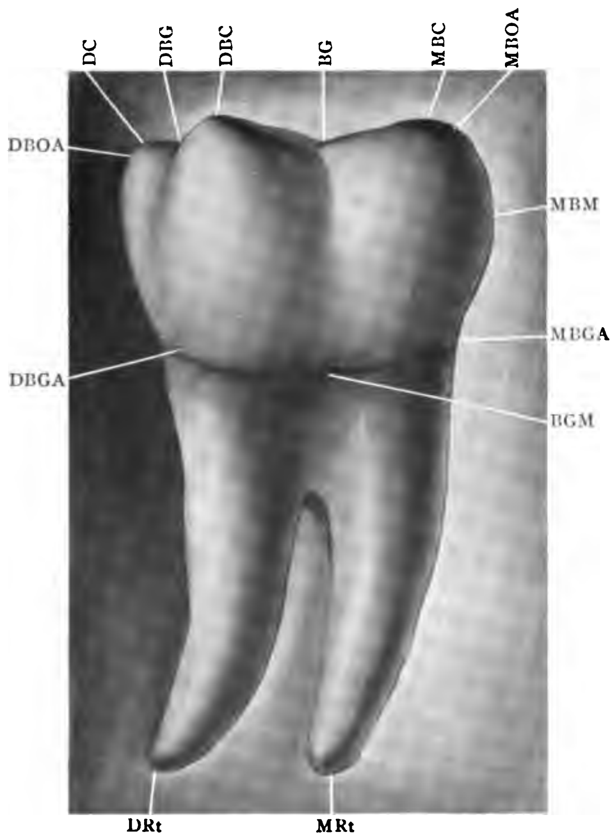


Fig. 35.—Buccal surface of the mandibular right first molar. DBOA, Disto-bucco-occlusal angle; DBGA, Disto-bucco-gingival angle; DRt, Distal root; MRt, Mesial root; BGM, Bucco-gingival margin; MBGA, Mesio-bucco-gingival angle; MBM, Mesio-buccal margin; MBOA, Mesio-bucco-occlusal angle; MBC, Mesio-buccal cusp; BG, Buccal groove; DBC, Disto-buccal cusp; DBG, Disto-buccal groove; DC, Distal cusp.

greatest amount of convexity near the gingival third, forming what is known as the bucco-gingival ridge. It will also be seen that the tip of the buccal cusp of the mandibular first premolar falls near the center of the tooth, and that the buccal cusp makes up about three-fourths of the occlusal surface. The lingual cusp is very small, the lingual surface of which presents very nearly a straight line with some convexity near the gingival border.

Fig. 30 shows the occlusal view of the mandibular first premolar and the long lingual slope of the buccal cusp is such as to slide the food into the oral cavity and past the proximal contact points, thereby avoiding the danger of the food

wedging between the teeth. The position of the central fossa is also important, as it is one of the factors which controls the mastication of the food and assists the mesio- and disto-occlusal marginal ridges to form a mortar in which the lingual cusp of the maxillary premolar crushes the food during mastication.

In passing to the molars we find the form becomes more complicated due to the addition of cusps and the placement of ridges and grooves, which give a greater masticating function than is found in the premolars. Considering the buccal surface of the maxillary first molar, shown in Fig. 31, it will be seen

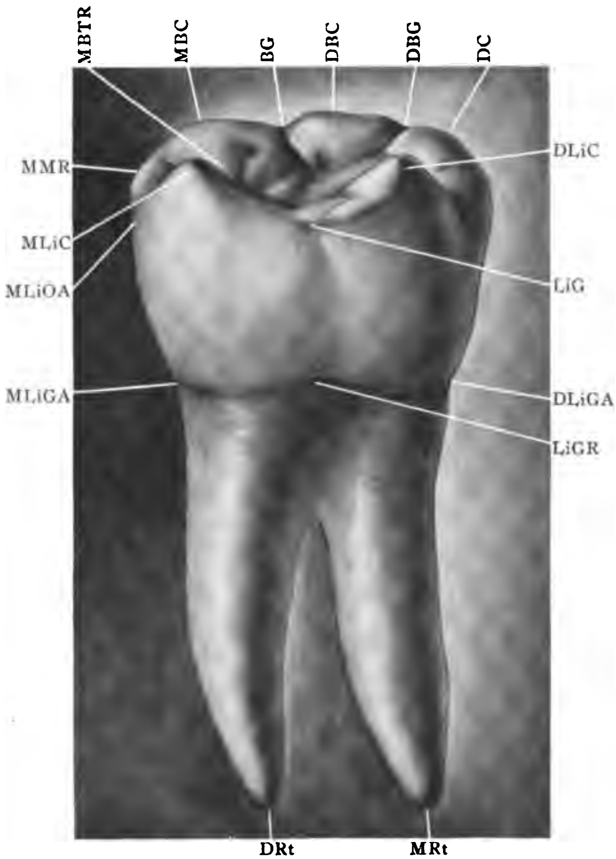


Fig. 36.—Lingual surface of the mandibular right first molar. MMR, Mesial marginal ridge; MLiC, Mesio-lingual cusp; MLiOA, Mesio-linguo-occlusal angle; MLiGA, Mesio-linguo-gingival angle; DRt, Distal root; MRt, Mesial root; LiGR, Linguo-gingival ridge; DLiGA, Disto-linguo-gingival angle; LiG, Lingual groove; DLiC, Disto-lingual cusp; DC, Distal cusp; DBG, Disto-buccal groove; DBC, Disto-buccal cusp; BG, Buccal groove; MBC, Mesio-buccal cusp; MBTR, Mesio-bucco-triangular ridge.

that the crown is a modified cube in which the mesio-buccal angle and disto-lingual angle are acute angles, while the disto-buccal and mesio-lingual angles are obtuse angles. Therefore, in looking at the buccal surface of the crown, it has the appearance of the buccal cusps being placed slightly mesial to the lingual cusps. It will also be observed that the occlusal diameter mesio-distally is greater than the gingival diameter of the crown mesio-distally, which is caused by the development of the proximal contact points and the mesio- and disto-occlusal marginal ridges.

Fig. 32, which is the lingual surface of the maxillary first molar, shows the

same difference in the occlusal and gingival diameters that is observed on the buccal side. It will also be seen that the lingual groove crosses the lingual surface in such a manner as to make the disto-lingual cusp appear the larger, which is not true when viewed from the occlusal surface. The mesio-lingual cusp may not be so long as the buccal cusp, but presents a much greater occlusal surface, and is a more important cusp from the masticating standpoint.

In Fig. 33, which is the mesial surface of the maxillary first molar, we observe the same occlusal constriction bucco-lingually that was observed in the premolar. This results in the buccal and lingual surface of the molar being

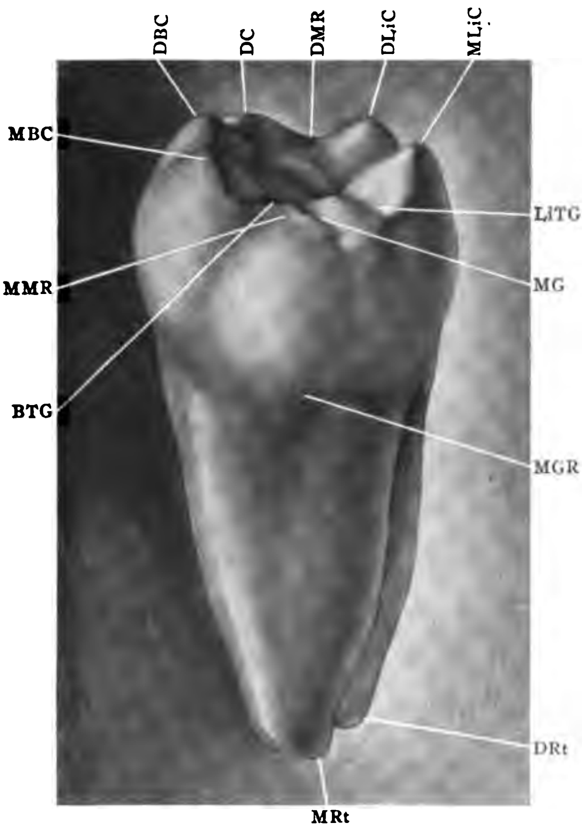


Fig. 37.—Mesial surface of the mandibular right first molar. The tooth is slightly tipped to show occlusal surface. MBC, Mesio-buccal cusp; MMR, Mesial marginal ridge; BTG, Bucco-triangular groove; MRt, Mesial root; DRt, Distal root; MGR, Mesio-gingival ridge; MG, Mesial groove; LiTG, Linguo-triangular groove; MLiC, Mesio-lingual cusp; DLiC, Disto-lingual cusp; DMR, Disto-marginal ridge; DC, Distal cusp; DBC, Disto-buccal cusp.

a convex surface, with the greatest amount of convexity near the gingival third. This development of the gingival marginal ridges is again for the purpose of protecting the soft tissues and must be very carefully restored if the soft tissues are to remain in a healthy condition.

The occlusal surface of the upper first molar, Fig. 34, shows the arrangement of the cusps, ridges, and grooves, all of which have a very important function according to their form. It will be observed that the triangular ridges of the mesio-buccal and disto-buccal cusps slope towards the central fossa and are separated by the buccal grooves which causes the occlusal surface to

have a greater masticating efficiency than if it was simply one ridge. The mesio-buccal triangular groove is so placed that after the food is crushed in the central fossa of the maxillary first molar by the buccal cusps of the mandibular it will be either deflected buccally past the proximal contact point, or lingually into the lingual proximal embrasure by the action of the lingual grooves. Owing to the excessive development of the mesial marginal ridge of the occlusal surface of the upper first molar there is a greater tendency for the food to pass distal to the central fossa then into the disto-lingual groove, which groove runs toward the lingual surface of the tooth and over the lingual marginal ridge into the oral cavity. The disto-occlusal marginal ridge of the upper first molar is also well developed, which again becomes an important factor in preventing the food from crowding or wedging in between the teeth. The long lingual slope of the mesio-buccal and mesio-lingual, and the buccal slope

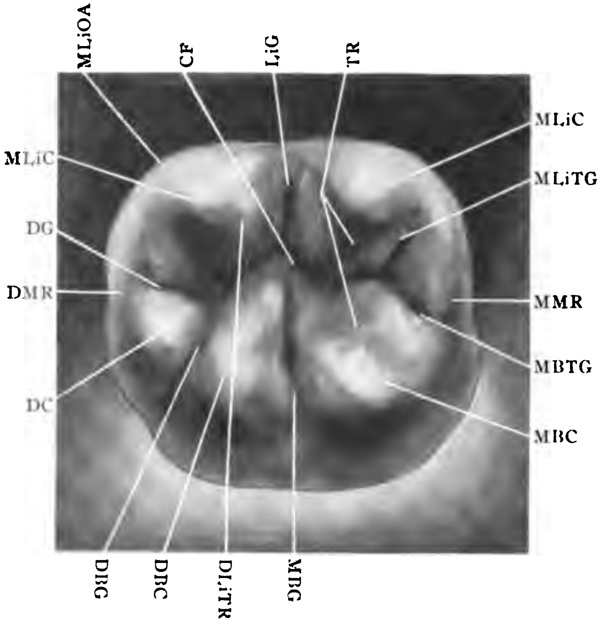


Fig. 38.—Occlusal surface of the mandibular right first molar. MLiC, Mesio-lingual cusp; DG, Distal groove; DMR, Distal marginal ridge; DC, Distal cusp; DBG, Disto-buccal groove; DBC, Disto-buccal cusp; DLiTR, Disto-linguo-triangular ridge; MBG, Mesio-buccal groove; MBC, Mesio-buccal cusp; MBTG, Mesio-bucco-triangular groove; MMR, Mesial margnial ridge; MLiTG, Mesio-linguo-triangular groove; MLiC, Mesio-lingual cusp; TR, Triangular ridges of mesio-buccal and mesio-lingual cusps; LiG, Lingual groove; CF, Central fossa; MLiOA, Mesio-linguo-occlusal angle.

of the disto-lingual cusps of the maxillary first molar are important factors in keeping the food on the occlusal surface of the tooth and, consequently, greatly increasing the masticating efficiency. It will again be observed that the buccal and lingual marginal ridges are placed nearer the center of the tooth than are the mesial and distal marginal ridges. This position of the buccal and lingual marginal ridges assists in forming the convexity of the buccal surfaces. The convexity of the buccal surfaces is such that the food is carried past the margin and that they assist the gingival marginal ridges in protecting the gum tissue. The mesial and distal marginal ridges being placed close to the extreme border of the tooth assist the proximal contact points in keeping the food from wedging in between the teeth, and also assist in causing the food to slide towards the central fossa rather than to slide into the interproximal space.

The buccal surface of the mandibular first molar, Fig. 35, is quite different from the buccal surface of the maxillary first molar. Nevertheless, the majority of artificial teeth that are made and a large number of the crowns that are constructed, have the buccal surfaces of the mandibular and maxillary teeth made in the same manner. It will be observed that the occlusal diameter of the tooth mesio-distally is much greater near the occlusal third than it is at the gingival third. There are also present two buccal grooves; namely, the buccal groove which separates the mesio-buccal and disto-buccal cusps, and the disto-buccal groove which separates the distal cusp from the disto-buccal cusp.

Fig. 36, which shows the lingual view of the mandibular first molar, clearly brings to mind the fact that the distal surface is shorter mesio-distally than the buccal surface due to the fact that it presents only two cusps. Only two cusps being present, there is but one groove on the lingual surface, which is the lingual groove. As a rule, it is deeper than the buccal groove so as to allow the food to slide out of the central fossa lingually into the oral cavity.

Fig. 37, which shows the mesial surface of a mandibular first molar, gives an idea of the comparative width of the gingival diameter of the tooth as compared to the occlusal diameter. It will be seen that the buccal and lingual marginal ridges occupy positions nearer the center of the tooth and that owing to the development of the buccal and linguo-gingival marginal ridges the diameter of the tooth is much greater through the gingival third than it is at the occlusal portion.

Fig. 38 shows the occlusal surface of the mandibular first molar and the arrangement of the ridges and grooves in such a manner as to make mastication most efficient. The well-developed mesio- and disto-occlusal marginal ridges in conjunction with the proximal contact points prevent the food from wedging in between the teeth. It will be observed that the ridges and grooves forming the central fossa are so arranged that there is greater tendency for the food to slide toward the center of the tooth and then out between the mesio-lingual and disto-lingual cusps through the lingual groove into the oral cavity. It will be observed that the triangular ridges of the buccal cusps are very long and, for that reason, are more important masticating surfaces than are the buccal ridges of the lingual cusps. It will be seen by studying the occlusal surface of the mandibular first molar that the buccal cusps occupy about three-fourths of the occlusal area, and, consequently, are the more important cusps from a masticating standpoint. The importance of the mesial and distal marginal ridges can not be overestimated when we consider that they are so placed as to prevent the food from wedging between the teeth and also are so shaped as to cause the food to slide toward the center of the tooth, consequently increasing the masticating efficiency.

As we study these various tooth forms, the buccal, lingual, mesial and distal surfaces of the anterior teeth, as well as the same surfaces of the premolars and molars, we will consider that these forms must have a very important function. When we consider the differences between the occlusal surfaces of the maxillary and mandibular premolars and the occlusal surfaces of the maxillary and mandibular molars, we will readily see that again the form must play a very important part as regards the functions of these teeth.

labio- and linguo-gingival marginal ridges are well developed, which can be observed from Figs. 22, 23, and 24. Fig. 24 shows the occlusal view of the tooth. It will be seen that the cusp of the tooth is much nearer the labial surface of the mandibular canine than it is the maxillary canine, and that the lingual border presents a greater slope than the maxillary canine. The extreme slope of the lingual border of the mandibular canine is to allow the food to slide past the lingual border and beyond the gingival gum tissue.

In considering the form of the premolars, we find that they are teeth which have been shaped for mastication; nature having provided them with a wide

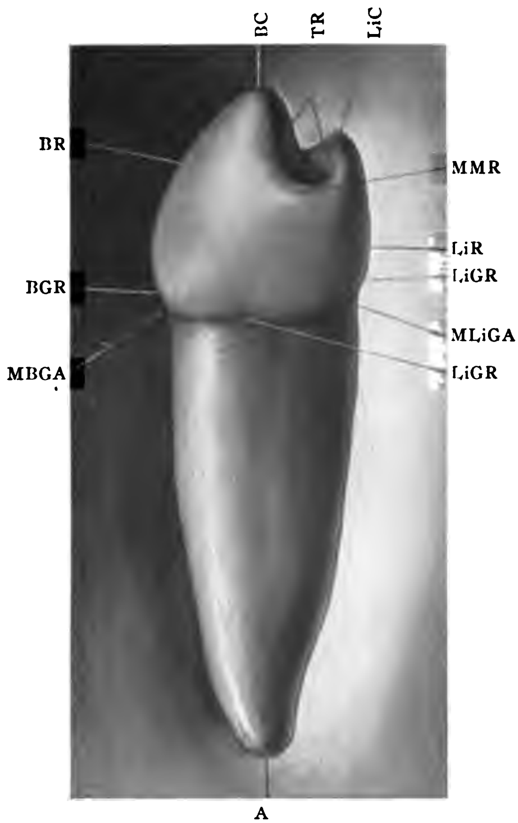


Fig. 29.—Mesial surface of the mandibular right first premolar. BR, Buccal ridge; BGR, Bucco-gingival ridge; MBGA, Mesio-bucco-gingival angle; A, Apex of root; LiGR, Linguo-gingival ridge; MLiGA, Mesio-linguo-gingival angle; LiGR, Linguo-gingival ridge; LiR, Lingual ridge; MMR, Mesial marginal ridge; LiC, Lingual cusp; TR, Triangular ridges; BC, Buccal cusp.

occlusal surface which has not been present in the other teeth considered. As a result of this, one of the most important functions of the tooth form of the premolars is that of mastication, and consequently the occlusal surface should receive much more attention than it has in times past. The mesial and distal proximal contacts of the maxillary first premolar can be accurately seen in Fig. 25, and it will be observed that the contact points are near the occlusal border or near the mesio- and disto-occlusal marginal ridge. It will also be observed by studying Fig. 26 that the buccal cusp appears to be longer than the

the result after eleven months of treatment by the use of the ordinary threaded alignment wire.

At this time the patient moved away and an active retainer was placed on his teeth and instructions were given to call upon an orthodontist in the city to which he moved. Subsequent events proved, however, that this had not been done, and the retainer which became loose at some point was taken off and thrown away some weeks later.

During the summer of 1917 the young man obtained a leave of absence from the aviation school and presented himself again for treatment. Fig. 3 shows the models of the case as it then stood; but, although the appearance and occlusion were both greatly improved, a comparison between Figs. 2 and 3 will show that the teeth had drifted considerably and a more perfect alignment was desired.

Fig. 3.

Fig. 4.

As the patient was quite reliable, I decided to use the removable appliances for treatment. Fig. 4 shows the upper and lower appliances which were immediately constructed and placed in the mouth. After a few adjustments were made and the appliances were perfectly comfortable, instructions were given the patient as to the method of taking them out and putting them in and the necessary prophylactic attentions. On the day before his return to the training camp, tension was placed in the finger springs and a slight amount of expansion given in the region of the bicuspids and a diagram made (Fig. 5) for the purpose of measuring the movement after each adjustment.

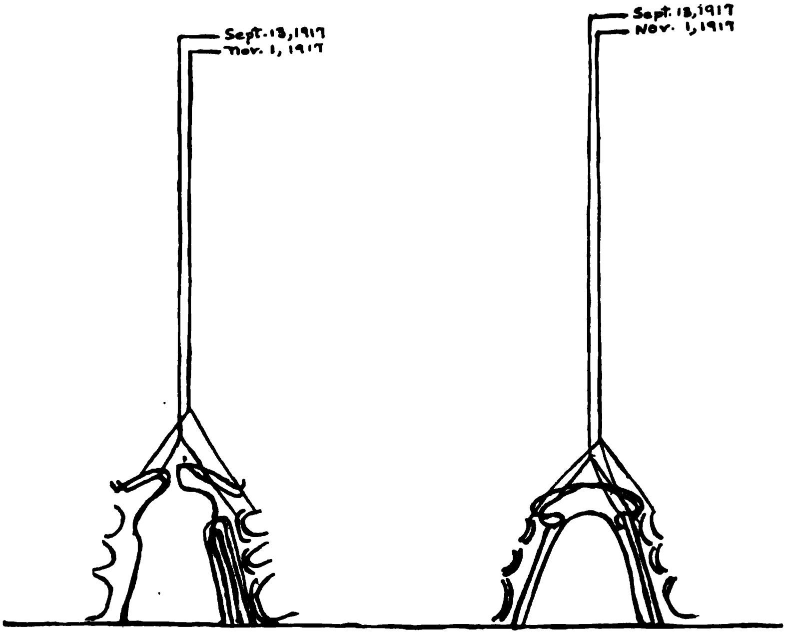
Instructions were given to return the appliance by mail every two weeks,

at which times, comparisons were made with the first diagram and the models, and new adjustments made calculated to give the necessary pressure for the next two weeks.

The diagram (Fig. 5) is marked at longer intervals than every two weeks as the lines would be so close together that they would blur. So whenever a sufficient movement is shown a new marking is made.

At intervals of about two months a piece of modeling compound is sent to the patient and a bite-impression is made. The patient does this for himself and after a few trials very creditable impressions were taken, sufficiently accurate to

Name.—Edward C. Waterman.
Address.—Aviation Training Camp, San Diego, Calif.
Parents or Guardian.—Mr. E. B. Waterman, Tulane and L Sts., Fresno. Cal.
Age.—16½. Diagnosis.—Neutro-Occ.



Examination.—July 24, 1915.
First Impressions.—July 24, 1915.
Second " —June, 1916.
Third " —Sept. 7, 1917.
Fourth " —...............
Last " —...............

Retaining Appliances.—.......................
Completion of Case.—.......................
Model No's.—.............................
Photographs.—............................
X-Ray.—...................................

Fig. 5.

make study models. These are of great assistance in following the course of work. Although it is orthodontic treatment under difficulties, the progress made is very gratifying. As the case is still under treatment finished models can not be shown, but, if it all goes as well as it has progressed thus far, the finished result will be very pleasing and satisfactory.

It would not be advisable to use this long distance treatment promiscuously, but by the proper selection of cases and thorough cooperation on the part of the patient very excellent results can be obtained.

THE POSSIBILITIES OF THE LINGUAL AND LABIAL ARCH —SINGLE OR IN COMBINATION

By A. C. Gifford, D.D.S., Oshkosh, Wis.

ALTHOUGH many articles have been contributed of late upon the use of this form of appliance, much more may be written, for we have in this, one of the most delicate, cleanly, and inconspicuous contrivances ever applied for orthodontic purposes. The marvelous things which may be accomplished by one who is proficient in the technic governing the application of one or both of these devices, seems almost beyond imagination, for there are no ligatures to impinge upon and irritate the soft tissues, and absolutely no appliance visible upon the labial surfaces of the teeth.

Lourie, of Chicago, recommends the solid or soldered attachment of the lingual arch, while Mershon, of Philadelphia, recommends the removable arch. These require an altogether different technic and as I have used but the soldered nonremovable one, I prefer it. As the adjusting or stretching of the wire must be done with care and exactness, I agree with Lourie when he recommends that until one has become experienced, the removable arch should be used, so that if necessary, it can be removed and adjusted, thus avoiding future complications. Until one has mastered the technic governing the adjustment of the wire, much harm may be done, as the pressure once applied, can not be relieved; the same being positive and movement of some sort must follow. The appliance, therefore, is treacherous, unless thoroughly understood. I consider that I have at times moved teeth more rapidly than was desirable, but even at that, there is never the alarming soreness which sometimes results from the use of ligatures.

To give you some idea of the "stretch" of a nineteen gauge, fifteen per cent iridio-platinum wire or a platinum-gold wire, it has been found that one can increase the length of such a wire, $\frac{1}{4}$ to $\frac{5}{10}$ or $\frac{6}{10}$ of its length before its usefulness is exhausted. This will very often cause sufficient tooth movement; but, in case it does not, it is no hard matter to attach a new lingual arch to the bands which are already upon the anchor teeth. There are great possibilities in this combination of the labial and lingual arch, and I believe that by slight additions, any movement can be accomplished that has been possible heretofore by the use of those more conspicuous and uncleanly appliances.

Before giving you anything upon the mechanical construction of this form of lingual arch, I wish to impress upon you that this apparatus is one, which not only successfully moves the teeth, but retains them as well, for what more efficient retainer could be made than the appliance which guides the teeth into their normal position? The lingual arch or combination of lingual and labial, is, therefore, an orthodontic appliance and a retainer combined.

Before constructing the apparatus, in order that it may accomplish all the tooth movement necessary in a given case, great care must be taken to ascertain just how much movement is necessary and where anchorage is to be applied. As the patients are of all ages, it becomes quite essential that our ap-

pliance does not reach beyond the necessary area and yet includes all of that portion requiring tooth movement.

My method of working is as follows: Having decided upon the anchor teeth and fitted the bands, I take an accurate modeling-compound impression with the bands on the teeth, and from this model, again make note of all the teeth which will require movement. In order to have the pressure greatest against those requiring the most movement, I scrape away a slight portion of those teeth in order that the wire may fit more closely, and adapt the wire as accurately as possible so that it will rest against the teeth that are to be moved.

Fig. 1.

I fasten the wire in place with pins and then go over it with the burner, heating it to a cherry red, which leaves it in a perfectly neutral condition. This can be accomplished in no other way. I use the high-fusing platinum-gold wire put out by Thomas J. Dee, which I find works very satisfactorily in my hands. I believe that when the appliance is first put in place in the mouth, it should be worn at least a week before pressure is applied.

When the time comes to put the labial arch in place, it will be found best to remove the lingual arch and bands from the mouth and to fit the entire appliance upon a model, for it is rather difficult to successfully construct a labial arch with the anchor bands on the teeth and in the mouth. The "spring" must also be taken out of the labial arch, sometimes called "body wire," by the application of heat; and it is best that this be done with the arch in place in the tubes. It is always safe to put tubes, either half-round or square, on the buccal side of the anchor bands, especially when attached to molars, and these may be

placed either mesio-distally or gingivo-occlusally. Personally, I prefer the gingivo-occlusal position, for it seems to hold the labial arch, or body wire, more rigid, and when locked in is also most desirable as it gives more stability to the anchorage and produces body movement of the anchor teeth. The labial arch, if perfectly fitted, is of no inconvenience and with the very small "finger springs" attached it is safer in the mouth than anywhere else. It is very inconspicuous and I have patients who say they would be willing to wear it the remainder of their lives if necessary. The lock should be so constructed that should any accident befall the labial arch or its "finger springs," it could be removed by the patient himself or some member of his family.

As to the "finger springs," their position depends upon the result one wishes to accomplish. There are a great many positions that they may occupy, and so many different movements possible by their use that one must govern himself accordingly. For example, take the case shown in Fig. 1 now under

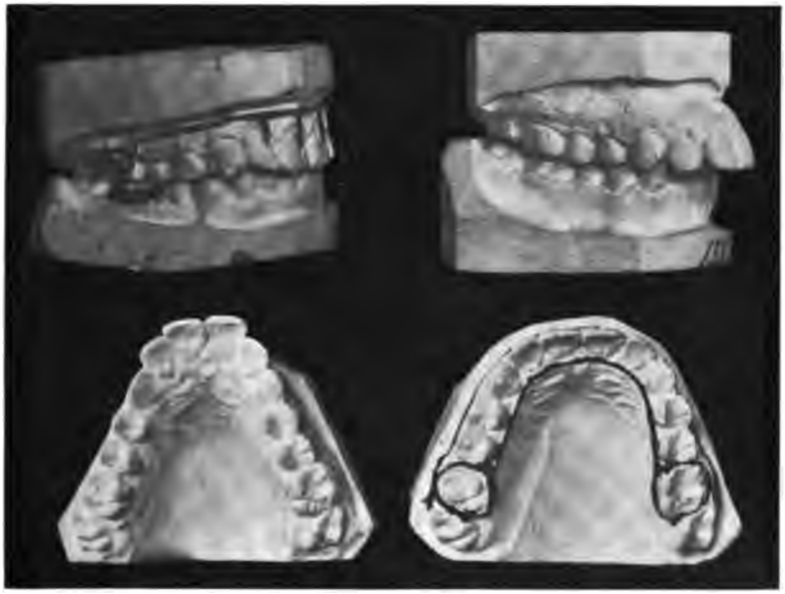


Fig. 2.

treatment, in which no other appliance has been used. After the upper lingual arch had been in place about seven months, and enough expansion had taken place to make room for the canines, I removed the appliance and attached 22-gauge "finger springs" to the molar bands in such a position that when neutral, they would be about where I considered the canines should be. I rested the "finger springs" upon the canines and the illustration shows what the result has been. Can you think of any appliance that would accomplish as much with as little visible upon the teeth?

Fig. 2 illustrates one of those cases, which required the addition of intermaxillary elastics when the usual form of appliance was used. I used the lingual and labial arch in combination. I say "in combination," but the lingual arch was in place for four months, widening the arch laterally, before the labial arch was applied. Another four months and a half have elapsed since then, and in view of the corrected condition, one can hardly fail to see the advantage

in the use of an appliance of this sort, especially when one remembers that it is the only retainer required when the correction is completed. However, one must use it to fully appreciate its fine points, its absolute cleanliness, and the perfectly healthful condition of the mucous membrane surrounding the gingiva.

In the construction of the appliance for use in cases similar to the one illustrated, one must remember that the lingual arch must rest only upon the premolars and distal portion of the canines, for at this point the expansion is to take place. Take into consideration also, the distal movement of the centrals and laterals, and see that enough space is provided to accommodate these changes. When the lingual arch is in place, the patient may have a slight disposition to lisp, but this soon passes away except in the case of a self-conscious person.

Now take the case of a lingually impacted canine: If the tissues are opened, and a pin cemented in the lingual portion of the impacted tooth, a lingual wire may be fitted and a "finger spring" attached as in Fig. 3. In this way the impacted tooth can be moved into line in a relatively short time.

When distoclusion is present, it is rather necessary that a band be cemented onto the first premolar with a loop resting over the lingual wire, for this will act

Fig. 3. Fig. 4.

as a preventive against the tipping of the anchor teeth. If the labial arch is also to be used, it is not a good policy to attach the intermaxillary hook to it, because the labial arch is placed so high, it will have a tendency to pull downward and to press the "finger springs" upon the anterior teeth more than is necessary. Conservatively applied, however, it is that pressure which comes from labial arch or body wire with its "finger springs" that is the most effective. The intermaxillary hook should not be fastened to the band upon the premolars as that will produce a loosening of the tooth and movement which is not desirable. I have experimented with various forms of attachment for the intermaxillary elastics, but the most satisfactory is that shown in Fig. 4. In case no labial arch is necessary, the wire may be soldered directly to the band. The lower attachment is, of course, a hook upon the mesio-buccal portion of the molar.

In the case of youthful patients, when the temporary canines are in place, one is often able to place the anchor bands upon them with a spur, soldered to the disto-lingual portion, extending back to include the first temporary molar and occasionally the second, and get all the expansion necessary for the erupting incisors.

ENDOCRINODONTIA, OR THE DUCTLESS GLANDS—THEIR EXPRESSION IN THE HUMAN MOUTH

By Herman E. S. Chayes, D.D.S., New York City

PART II

Dr. D. M. Kaplan, the director of the laboratories at the Neurological Institute of New York, published an article in *Endocrinology* of April, 1917. He called this article "An Endocrine Interpretation of the Dental Apparatus."

The quotation of this article in full will be illuminating, particularly since I wish to point out what appear to me to be some slight errors in his conception and nomenclature.

"There is not the least doubt that the glands producing internal secretions exert an influence upon the exterior of the individual. Although the uninitiated still may consider certain individual peculiarities as accidental, the endocrinologist knows which organ, or organs, were instrumental in the production of these seemingly accidental phenomena. To ascribe a certain bodily appearance to accident is a confession of ignorance, which, however, is becoming less frequent the more one studies the mystic forces of the endocrines. The study of their functions can not be severed from the study of these glands, so much so, that one may justly call this specialty an investigation of the 'compensatory dynamics of the endocrines in health and disease.'

"To understand the compensatory workings of the endocrines is to know 'internal secretions;' and to be able to translate it into terms of physiology and pathology is to know how to handle your patient from an endocrine point of view. There are many external manifestations resulting from the work of the endocrines that have been carefully studied, many that are only superficially known, and still more to be discovered in the future. To the endocrinologist a pigmented mole is not an accident, nor the mustached female of twenty-five, nor the soft pulse at eighty, nor the high blood pressure at thirty, nor the enlarged, noninfected tonsil. It is the why and wherefore of a peculiarity that is the constant question before the endocrinologist, and very often the answer is radically opposed to orthodox allopathic thought. Therefore the uninitiated may be perplexed by the stand taken by the student of compensatory dynamics, who argues against the reduction of a high blood pressure in a certain patient, or the removal of the tonsils in another, and yet he may offer very sound reasons for both conclusions.

"In his endeavor to arrive at the truth, the student of 'compensatory dynamics' takes into consideration the fact that certain infections have an affinity or, as I have designated it, a 'tropism' for certain glands with internal secretion. For instance, it is known to all that mumps is an infectious disease that often attacks the gonads. It has been noted that diphtheria and

typhoid have a tendency to cripple the adrenals, so that mumps is known as a gonadotropic infectious disease, while diphtheria is an adrenotropic.

"There is also a definite tropism between endocrine disturbances and the dental apparatus. Ewan Waller, of Birmingham, England, has very definitely associated the teeth in children with the thyroid function. It seems that the glands with internal secretions play an important role not only in the structural, but also in the physiochemical economy of the individual. A great number of the unclassified subjective disturbances formerly designated as neurasthenia, neurosis, or hysteria, and lately as vagotonia, can be more justly ascribed to an aberration or a disturbance in the compensatory dynamics of the endocrines. The thorough investigator of the constitution of an individual in health or disease takes into account the phenomena not only as pictured in our books on diagnosis, but also the time of day or night, the amelioration or intensification of symptoms in the evening, its involvement of the right or left side of the body and he differentiates where the same complaint appears in the juvenile, adult, or senile individual.

"There are a great many points dismissed by the uninitiated as insignificant, which the endocrinologist employs to advantage in building up a picture of disturbed equilibrium in a patient. The peculiarities of the dental apparatus is one of them.

"*Thyrodontia.*—It is a fairly well-established fact that the calcium metabolism is governed chiefly by the thyroid apparatus, and secondarily, by the rest of the endocrines. The alkalinity of the saliva to a certain extent depends upon calcium salts. It is to be seen how a disturbed endocrine equilibrium could bring about dental decay by a disturbance in the calcium metabolism balance, particularly in children who depend upon their thyroid and thymus more than the adult and senile. The calcium being deficient, the acids from food decomposition are not neutralized, and the dentine consequently suffers, this being one of the stages in the complete breaking down of the tooth. In children particularly, a well-balanced thyroid and sound teeth go together. If the thyroid is not performing its duties properly, the tooth to suffer first is the molar. The submaxillary saliva is said to be richer in calcium than the parotid, and in view of the fact that the molars lie behind the duct, their supply of immunizing saliva is less than the front teeth, and hence, in case of calcium deficiency, they succumb first. This is manifestly apparent in the longer life of the lower front teeth as compared with the upper, the latter not having the constant salivary bath enjoyed by the lower teeth. This is very characteristically displayed by the woman with an exhausted thyroid, due to repeated pregnancies, who invariably loses her upper incisors. Of course in such women the other endocrines enter into the mechanism conducive to dental loss.

"To start with, thyroid teeth are distinguished by their slender frame, they are thinner, more transparent, and graceful, and their color tends toward a bluish gray white. Children and married women with such teeth can be saved a great deal of dental trouble by the discreet and timely administration of thyroid extract. The frequency of the therapeutic display depends entirely upon the case and the acumen of the physician.

"In the multipara the dental situation from an endocrine point of view

is only partly thyroidal. The interplay and compensatory work of all of them are necessary to help her through this physiologic symbiosis. If the woman is deficient in any of the endocrines, she will display not only dental changes, but all kinds of other objective and subjective manifestations depending upon the glands or gland involved. The falling out of the upper incisors independent of decay, bears a distinct pituitary stamp and one may say that the maxillary sockets become too large in some pregnant women, and that the root is not firmly implanted in such a jaw, at this episode of partial transient physiologic acromegaly. It is the duty of the discerning physician, as well as the dentist, to guard against irreparable loss, disfigurement and suffering of patients by a timely use of thyroid extract in cases of dental caries or late eruption, as well as in gestations that promise injury to the teeth.

"*Pituitodontia.*—Many individuals who are free from complaints that would compel them to seek a physician's advice, are the possessors of teeth characteristic of the acromegalic. The owners of such teeth need not develop acromegaly, nevertheless they must be regarded as potentially pituitary. Chronic frontal headaches and the slightest limitation in the temporal visual fields, require very earnest attention and extremely judicious endocrine therapy, for at such a stage one might hold out some hope of deferring the advent of the full-fledged acromegalic picture. Increase in size of the acral parts is the chief objective sign of this disease and the pituitary is the gland responsible for its appearance.

"It must not be forgotten, however, that not only an increase, but also a very marked diminution in size, belong to the activity of the pituitary gland; so that giant and pigmy are endocrinologically related. The same applies to the teeth. The average pituitary dental arrangement shows large square teeth; oftener than not the upper middle incisors are spaced (trema) and the rest of the teeth may share in their separation, stopping at the bicuspids. On the other hand, marked overcrowding is a feature which also belongs to the department of hypophyseal activity, so that one is frequently confronted with a situation requiring great care in endocrine interpretation. The gestating female has been referred to before, but it must be reiterated, that the falling out of the incisors, particularly the lateral one, has a double meaning. At present let us not forget that the middle upper incisors are preeminently the teeth closely associated with direct primary pituitary function. This does not signify that the individual has a pituitary abnormality incompatible with perfect health; it may show itself in anybody with accepted hypophysial markings, such as being very tall or very short, having a very large head, particularly in the frontal part, or manifesting a tendency to adiposity in the young or adult, with or without hypogenitalism. It may accompany the feminine type of man who shows his abnormality in his teeth only, and his sexual anomaly in his psychoanalysis.

"*Gonadodontia.*—Individuals with a gonadotropism may give in their history an attack of mumps during childhood. Close relationship between this contagious disease and the genital glands is established by the frequent involvement of the ovary or testis in a complicating inflammatory reaction. It is not necessary that the individual previously having had mumps should present earmarks of a definite gonad disease, he may yet show them in the future or not

at all. This depends entirely upon the compensatory work of the rest of the endocrines.

"In all endocrine manifestations not only the soma, but also the psyche is influenced. Besides these psychic attributes most of them show definite somatic stigmata, of course not all of them, the exceptions here as elsewhere serving to establish the rule.

"In the gonadotropic individual the dental apparatus carries a very striking earmark of the tropism. If the middle upper incisors carry a message from the pituitary, the lateral upper incisors certainly do the same from the gonads. So that when the gonads are teratologically *ab ovo* definitely abnormal, one is sure to find some abnormality in the upper lateral incisors. The relationship, if any, is a crossed one, so that the right upper lateral incisor may point to the left testis or ovary, and vice versa.

"It is also to be noted that the greater the deviations from normal, the more definite the markings in the dental department, so much so, that the lateral incisors, as a result of a marked gonad defect, may not have erupted at all. Such a dental situation is rare indeed, so is also the clinical condition presented by the patient who has it. Here is a situation that the gynecologist could profit by, and the surgeon add another sign to the significance of right-sided abdominal pain. Such a pain is usually ovarian, when the left upper lateral incisor is faultily implanted, showing the mesial edge of the tooth anteriorly, and protruding in front of the middle incisor. The teeth presumed to be connected with the gonads (upper lateral incisors) carry the stamp of ovarian or testicular abnormality in their size, shape or implantation.

"The ovary should always be suspected where pelvic pain is manifested in a patient whose lateral incisors are abnormal. In the male, small stumpy laterals bespeak sexual impotence on a physical basis, many gonorrheas, prostatic insufficiency, and chronic strictures. In such an individual one may obtain the history of mumps, and if he had a rightsided orchitis or epididymitis, more often than not his left upper lateral incisor will be differing from the normal, taking his entire dental apparatus on the standard of comparison.

"On rare occasions the compensatory work of the other endocrines is so well adjusted that the dental anomaly is obliterated, and gives no clue to the existing gonadopathy. There are, however, other external signs from an endocrine point of view that would direct attention to the existing state of affairs. As the dental apparatus is the subject of this paper, the other signs will not be discussed.

"There is a dangerous tendency among endocrinologists to designate with peremptory precision that this or that organ is involved, and is responsible for the endocrine picture. Very often the external manifestations are caused by another gland whose functions it may be to bring about phenomena on the surface of the patient, such as, for instance, the adrenal system; and some students may be carried away by this easily demonstrable, superficial appearance, and be led to assign to the objective findings the place of first importance; whereas, the adrenals have simply acted in response to a call from some other gland. The gonads always require adrenal help in performing their work, and when they do not come up to the physiologic requirement, be this in the

form of under- or overactivity, the adrenals are then called upon for additional assistance, resulting, secondarily only, in manifestations appearing on the skin, mucous membranes, hair, etc. The primary, *ab ovo,* situation can be read from the teeth and the gland responsible for the trouble more often than not, can be unerringly named and proper therapy suggested. It is remarkable how readily the patient responds when the proper drug is prescribed, but here, as elsewhere, the futility of attempting replacement therapy in some cases must be thoroughly gauged.

"A young woman suffering from the torture resulting from a complete oophorectomy can not be benefited much by ovarian extracts, be it the whole gland or the luteal portion. In some cases one must be able to read intelligently the symptomatology, and curb as much as possible the pituitary compensation, for in such cases, this is the gland that may be causing much of the subjective discomfort. If the pituitary, however, is not capable of compensation, or is only partly able to assist, the adrenal and thyroid systems are employed to overcome the deficiency. Depending upon the fitness of these glands one will have a predominating adrenal or thyroid symptomatology. Therapeutic success depends entirely upon our ability to recognize the vicarious execution of functions by glands with a different purpose.

"*Adrenodontia.*—It is to be conceded that the ability to perform better work requires better tools. In biology this is everywhere evident. From times immemorial the longer and sharper tooth was part of the outfit of the pithecanthropus, whose survival was assured. Such a specimen was perhaps also the hairiest of the tribe. As time advanced and the necessity for using the teeth in offensive and defensive existence became secondary to the special development of the thumb and hands, the chief fighting teeth, the canines, became shorter, and in some very peaceful members of our semisimian ancestors, also less sharp. With the greater use of the hand came the perfection of that part of the brain that serves as the storehouse for memories. These memories became the heritage of the future man, and with the greater specialization of the hand, the teeth were gradually discarded as weapons of defense and offense. The emotions in the state of offensive rage still cause the display of them, although one does not use them.

"Vasomotor force and the tone of muscles depends upon the proper work of the adrenals. Only when these glands work better than the others, it is possible to think of the enduring prizefighters. When the pituitary is equally well adjusted, one has the heavyweight champion type. But the ability to scrap, whether curbed by education or environment, or not, is indelibly marked in the canines. As one of our ancestors would have learned by experience that his short and blunt canine was no great weapon in a fight and would have become the champion of peace instead of conflict, so also the present man prefers discretion to valor because of his inadequate adrenal endowment or, as one may term it, lack of biologic equipment for strife. Whether man or woman, both show in a long sharp canine an atavistic remnant of a bellicose progenitor, and upon proper provocation justify the above contention.

"Very often the large and sharp canine in a woman bespeaks the aggressive agitator, public speaker, or militant suffragette. Some of these women studied

from the point of view of biologic balance possess other endocrine markings, showing that they are not women to the full extent that nature intended the average woman to be. The woman whose skin is rough, who finds pleasure in curbing wild horses, who cares not for the duties of home life, and who is an expert administrator (purposely using the masculine) must give up a certain amount of natural feminism in order to be able to enjoy and accomplish the above things. Very often with such traits goes a masculine hand, a mustached lip, a large-pointed canine, and a deficient gonadodont. The sexual psychopath could be detected by a study of his dental apparatus, and the endocrine therapist might supply the glandular extract that would give a more natural trend to the twisted psyche of the possessor.

"The spinster who truly rejoices in her single blessedness does not do so from choice, but rather from her innate promptings. Being less of a woman than her well-balanced sister, she does not require the society of a man, and frequently shows her genuine distaste for such company by an appropriate remark. In her pursuits she wants to dominate and frequently fills with credit a position requiring great virility. She abhors the evening gown, and wears clothes of a masculine type, low heels, no corsets, side pockets, collar, and tie.

"The male counterpart with short, stumpy and dull canines gives up some of his primordial male aggressiveness, and becomes the Jacob instead of the hairy Esau. The kitchen is his place, he can sing in high notes, never a basso, and has the greatest inward storms when the time comes for him to propose marriage to his heart's choice. Such a man stands a poor chance of being accepted by a girl well balanced from an endocrine standpoint. It is the one who will not enlist to help defend his country, but will offer a thousand and one reasons why he should not fight, that war is a reversion to barbaric times, etc. Such men are afraid that a gun might go off, and in business are equally nonprogressive. The eternal clerk, messenger boy, cook, and other nonprogressive occupations are theirs. Endurance, progressiveness, discovery go hand in hand with an endocrine system that is perfect, and a canine tooth that fears not to face antagonism in any shape or form.

"The adrenodont in its structure gives us a clue to the adrenal balance of the individual. There is another characteristic of the adrenal tooth, the color. The grinding surface of such teeth shows a marked reddish brown coloration (Chayes), and although softer in texture than the thyroid or pituitary variety, they have a greater degree of endurance (Chayes). Here again is a hint of the ability of adrenal secretion to protect. Old men or women will show short teeth still in a very good state of preservation and most freely marked with this reddish brown pigment. Younger people with such teeth can be assured of their lasting character, and it is astonishing to note how some of them remain intact regardless of the lack of care and the thick wall of tartar that surrounds them. Age or the ability to grow old goes hand in hand with proper adrenal work, of course with the assistance of the other endocrines; and so adrenal markings in the form of pigment insure not only the life of the tooth but also its possessor. Individuals who become patients on account of improper adrenal work may show this peculiarity in their teeth also, the marking here indicating the gland affected as well as suggesting the proper therapeutic course to pursue.

"*Thymodontia.*—The tooth of the baby is bluish porcelain, thin at the grinding edge, and translucent in that part. The tooth in some children shows a tendency to scalloping at the grinding edge. This trait may outlast the baby and in rare occasions be found in the adult. The other infantile characteristics may go with it such as a red cheek, an excellent digestion and a tendency to diarrheas. The finding of such teeth in the adult points to the youth of the individual, regardless of years. In this persistence of juvenile characteristics, one must always weigh the compensation offered by the other glands with internal secretion.

"The purpose of this communication will have been accomplished if the physician and dentist will begin to see in the dental apparatus a greater purpose than the sole function of mastication. When fully studied upon lines suggested above, a volume of facts will be discovered that heretofore may have many times been entirely overlooked."

Dr. Kaplan calls the entire ductless gland expression as observed in various individuals "compensatory dynamics;" I feel that this term will be misleading. The action of these glands, particularly the adrenals, the thyroid, and the pituitary is dynamic to be sure, but not compensatory in the true sense of the word. If they were compensatory, surgeons might, with impunity, remove any one of the glands and expect the other one or two of them to assume the function of the one removed.

We know that this does not take place. As a matter of fact, the remaining glands will be much disturbed in their expression of function.

So close is the interdependence of these glands in their function, that not one may be hurt or tampered with, without immediately calling forth resentment in the others.

But interdependence of dynamic expression is not now and never can be compensatory dynamics, and Dr. Joseph Fraenkel and his associates, to whom most of us owe our correct information on the subject of ductless gland activity, their physiology and function, and their therapeutic use and value, never meant to, and never did, to me at least, convey the information or impression that they were compensatory in the sense in which Dr. Kaplan seems to conceive them to be.

Dr. Kaplan is correct in attributing to the ductless gland chain a marked influence upon the dental apparatus, its formation as to position and quality, hence resistance to destruction by decay. It is well established, beyond the necessity for further vague experimentation, that the breaking down of dental tissues to wit, teeth and environs, may be modified if not altogether, at least, to some considerable extent by ductless gland therapy. I called the attention of the profession to this subject about two and one-half years ago in my thesis on the functions of the teeth.

Dr. Kaplan is again hasty in his nomenclature. There is no such thing as thyrodontia or piptuitodontia or adrenodontia, etc., any more than we could improvise a science of pneumodontia or intestinodontia; a happier name for his article would have been "Endocrinodontia," because such a name would have covered the subject.

His remarks regarding the influence of the gonads upon the position of the

laterals in the superior maxillæ is correct, but that this influence is a crossed one has not been borne out in all experiences, also it must be remembered that this influence is not a direct one but is exerted through the pituitary.

Thyroidal teeth are long, well-rounded, bell-shaped, and of a beautiful bluish white texture shading into yellow at the cervical margin.

Pituitary teeth are short or long, not so bell-shaped, more or less square-shaped anteriors are the rule, yellowish gray in color.

Adrenal, or so-called adrenal, teeth are small bell-shaped organs rapidly yielding to attritional wear, occlusal surfaces show reddish stains, they resist decay remarkably well, are yellowish white in color, quite yellow at the cervical margin. Erosion of teeth at cervical portions is, to my mind, an adrenal phenomenon and manifests itself in many cases which are potentially neoplasmic. The same is true of teeth which seem to possess an inherent principle of immunity.

Thymic teeth may be thyroidal or pituitary in character with the addition of scalloped, fan-shaped occlusal or incisal surfaces. They are very translucent and of a milky white or bluish white color.

May we not conclude from all the foregoing that:

When a little child presents himself to us and the little one's teeth are in malrelation to one another, we ought to know how to correct this situation without harnessing this little masticating apparatus in all sorts of unspeakable and distressing appliances, furthermore, we ought to realize that this very malrelation of the teeth is an expression of a constitutional state to be ministered to, not by irritating the structures in the mouth, but by gently recalling to its proper sphere of activity and supervision, the delinquent part of the mechanism, the temporary aberration of which caused the malrelation—a thymopituitary state.

When a little one whose teeth decay readily, despite all attention to hygiene, presents himself to us for our attention and aid, we should so minister to the potential man or woman in it as to recall to its proper sphere of activity and supervision, the delinquent part of the mechanism, the temporary aberration of which caused the dystrophy—a thymothyroidal state.

When a little patient whose posterior teeth are in malrelation and show reddish stains on the occlusal surfaces, presents himself to us for attention, we should be able to recognize an expression of a thymopituitoadrenal stress and so minister to the little one as to recall to their proper sphere of activity and supervision the delinquent parts of the mechanism, the temporary aberration of which caused the dystrophy.

When a little patient whose teeth in the premaxillary region of the maxillæ are in malrelation presents himself, we should recognize this as a prenatal pituitary state and so minister to the little one as to recall into proper sphere of activity and supervision, the delinquent part of the mechanism responsible for the particular expression.

When a little patient whose lower anterior teeth are in malrelation, presents himself, we should recognize this as a postnatal pituitary state and so minister to the little one as to recall to harmonious interplay the delinquent part of the mechanism, answerable for the particular expression.

A little child who presents himself with its upper laterals in torsion, is possessed of some gonadial disbalance, indicating, perhaps, a senile gonadial apparatus, a prenatal pituitogonadial state and should be so treated as to recall, if possible to proper sphere of activity and supervision, that part of the mechanism, answerable for the particular expression.

These few paragraphs may be summed up in the following sentences:

First, dentition as to time, is a thymopituitary function.

Second, dentition as to position, is a thymopituitary and gonadopituitary function.

Third, dentition as to quality is a thyropituitary function.

Fourth, dentition as to resistance is a thyroadrenal function.

It follows from this that the first permanent molar erupts in normal position in the upper arch when the thymothyroidal apparatus is in balance and when there is no prenatal pituitary disturbance.

It erupts in normal position in the lower arch when the thymothyroidal apparatus is in balance and when there is no postnatal pituitary disturbance before six years of age. The above holds true in sequence mentioned for the upper and lower temporary set of teeth.

The bicuspids and second permanent molars and cuspids are most often in malrelation in females, because they erupt at a time of or immediately after puberty or at a period when the pituitary is called upon to adjust itself to and to interplay with the awakened gonadial apparatus, a critical time in the life of a female individual. The same holds true in a male person but to a lesser degree.

The torsion of the permanent laterals indicates an anomaly of the uterus as to position or some ovarian difficulty in the female and some testicular disturbance in the male. When the torsion is very decided in the latter, one may safely assume the presence of a varicocele in the patient.

If the permanent cuspids are forced out of position by apparent lack of space, they point in females to ovarian disturbance such as cysts, fibroids, etc. In males they are an indication of recurrent obscure pains in the lower abdominal region with sensitive areas in the region of the groins.

If these cuspids are markedly prehensile in formation, they indicate an abundance of the sexual urge as mentioned in a previous chapter of the book.

Individuals whose teeth suffer from erosin at the cervical margins and upon the labial surfaces and which present an enamel surface which is highly polished and of a greenish white hue bid fair to be candidates for neoplasms, particularly so when red-haired.

The spacing of the anterior upper teeth is a pituitary signature and often tells a story of headaches, constipation, and other gastric disturbances.

Teeth, which have undergone marked change in macroscopic appearance due to attrition, invariably tell, in dark people, a story of freedom from infectious diseases, outside of perhaps measles and diphtheria or whooping cough, but also point to the predisposition of the person to disturbances of a circulatory nature and afflictions of the lower portion of the large intestines.

We see cases of mature age which present teeth of marked youthful appearance. We call them thymic teeth and they tell a story of a pituitary and

gonadial battle against a powerfully entrenched thymus, resulting in a compromise, definitely expressed in an occlusal relation between upper and lower teeth which permits of the virtual perpetuation of the incisal and occlusal surfaces characteristic of children's teeth.

I am convinced that a deep study of the endocrines and a careful therapeutic application of them, would, to a great extent, if not altogether, eliminate the endless dystrophies manifesting themselves in the oral cavity; and thus obviate the call for a great number of tedious, and for patients, very painful operations.

I appreciate the fact that many will read this chapter with great skepticism, and I can readily understand why this will be so; but I would ask these readers to abide in faith and read some of the books to be recommended and then carefully observe their patients, question them at length and so learn from their own daily practice to understand the wonderful interdependence which exists between the endocrines and the dental apparatus and how perfectly they express themselves in the size, texture, quality, and position of the teeth and their environment.

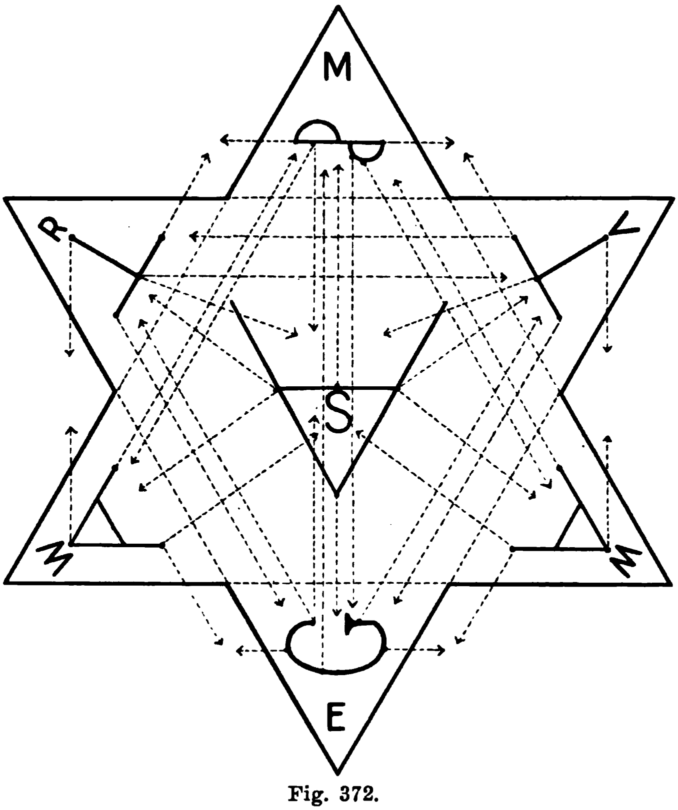


Fig. 372.

THE CREATIVE FORCE AT WORK

In the accompanying diagram (Fig. 1) two triangles are seen superimposed one upon the other, making a six-pointed star—the Protector of David. It represents the conception I have of the Universal Spirit or Mind or Soul work-

ing upon itself and expanding in consciousness from within outward, so that it begins to manifest itself in various ways on different planes (creation).

The fact that these triangles are so placed that one presents with its apex downward and the other with the apex upward, will mean much to those who have studied occultism and are familiar with the literature on symbolism.

We see here the large *A* in the center of the illustration. In the apical portion of the *A* we see an *S* to represent the Sun, the energizer, the father, he, who with his warmth, animates the Universe. Directly above, we see the point of the star marked *PP* representing the pituitary beneath which rests the pineal. Within this point of the star, the *M* represents the Moon with its psychic significance to man.

The point on the upper left marked *T* represents the thyroid and the *R* within it stands for the restless, ever-moving atmosphere.

The point on the right, also marked *T* represents the thymus or youth or beginning of man. The *V* within this point represents the vegetable kingdom, even as the *R* in the opposite point represents the mineral kingdom with its finely-divided silicious and other mineral particles floating in the ether. This *V* representing the flowers and trees and leaves upon the trees is symbolic of ever-recurring youth.

The two points below, the right and left *A* represent the adrenal bodies or energy made manifest on the human plane. The *W's* within these points represent the waters of the earth.

And finally, the point below marked *G* for gonads, expressing immortality on the procreative plane. The *E* within this point represents earth or the place where man must reach a certain stage in his unfoldment in order to be worthy of his Creator.

Please note the number of intercommunicating lines along which impulses or hormones or whatever we may choose to call them may travel.

If we now look upon the large central *A* as the heart of man we shall have a picture of him as the microcosm within the Universe and we may note how the adrenal, the pituitary, the pineal, the thyroid, the thymus, and the gonads all have their heart valency and how conversely the heart presents its radiant impulses impartially to all of them.

The vast influence of these glands may be further graphically illustrated by lines or arrows going from the six points of the star to all parts of the body. Such as skin, hair, teeth, muscles, ligaments, lungs, liver, bowels, eyes, ears, nose, throat, that is, pharynx, larynx, tonsils, etc.

The net work is so vast and the interdependence so intimate that it would require a volume of considerable size to cover the subject.

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DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

PYORRHEA ALVEOLARIS IN RELATION TO SYSTEMIC DISEASE

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PYORRHEA alveolaris is rarely due to one cause alone. In an overwhelming majority of cases it is due to one chief cause and several important contributing causes. The more important causes are mechanical conditions which expose the gums repeatedly to injury or to the irritating effects of putrefying food material, secretions, etc.; systemic or local conditions which increase the susceptibility of the gums to infection and finally infection itself. The successful treatment of pyorrhea depends upon the removal of each abnormal condition which takes part in its etiology.

CAUSES OF PYORRHEA ALVEOLARIS

1. *Microorganisms;* streptococcus group, pneumococcus group, staphylococcus group, amebæ, spirochetæ, and fusiform bacilli of Vincent's angina, bacilli of many types, putrefactive organisms, etc.

2. *Chronic irritation or trauma,* such as that caused by tartar, decay, malocclusion, defective dental work, and, perhaps, in rare instances, by the improper use of toothpicks, toothbrushes, etc.

3. *Unsanitary conditions,* such as may be caused by pockets and irregularities of the teeth which make possible the lodgement and putrefaction of secretions, food materials, etc. Such may occur as a result of defective dental work, tartar, decay, irregularity of the teeth, etc.

4. *Conditions which prevent the normal massage of the gums and cleaning of the teeth* by the excursion of food, the tongue, and cheeks during the process of mastication; namely, malocclusion, irregularity of the teeth, and defective dental work.

5. *Constitutional conditions which increase the susceptibility of the gums to infection;* namely, diabetes, pregnancy, lactation, alcoholism, lead poisoning, the use of mercury and potassium iodide in therapy, chronic debilitating diseases, blood diseases, anemia, etc., diseases of the ductless glands, scurvy, acute infectious diseases, chronic infections, such as infected tonsils, alveolar abscesses, infected nasal sinuses, chronic appendicitis, cholecystitis, etc.

The above factors vary in their relative importance, and each factor varies in its degree of importance. Several factors play a part in the majority of cases. When this is the case, relatively unimportant factors may play important roles. For example, acute trauma, such as that brought about by injury or by the use of toothpicks, stiff toothbrushes, etc., seldom or never causes pyorrhea in normal individuals with normal teeth, in fact, stiff brushes are used in prophylaxis against pyorrhea. In a patient with diabetes, however, or in preg-

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Figs. 1-4.—Illustration showing a normal condition of roots and alveolar process. Figs. 1 and 2, in adult life. Figs. 3 and 4, before eruption of second teeth.

Fig. 5.

Fig. 6.

Figs. 5 and 6.—Osteomyelitis of the jaw derived from an infection at the roots of a molar tooth which were extracted before the roentgenogram was taken.

nant women, acute trauma may initiate an infection of the gums, especially if, in addition to this, the patient has tartar or defective dental work. Likewise, the irritating effect of defective dental work which might be well tolerated by a normal individual might be a source of severe pyorrhea in an individual taking intensive doses of mercury or potassium iodide, or in an individual with irregular teeth having accumulations of tartar, etc.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Figs. 7-10.—Case of pyorrhea alveolaris of long standing. Shows great destruction of the alveolar process.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Figs. 11-14.—Illustrations of cases in which the alveolar process has been so destroyed by infection that some of the teeth are held in place by soft tissues alone. Pressure on such teeth during mastication forces them down on cushions of chronically infected tissue. They would appear a greater menace to health than infected teeth whose roots are still embedded in bone and held in place more firmly. The teeth shown in Figs. 13 and 14 had been treated for two years by a pyorrhea specialist. The surface of the gum was pink and appeared relatively healthy. Marked relief of systemic complaint followed the extraction of teeth in each of the cases illustrated above.

As previously mentioned, the majority of individuals with pyorrhea show the presence of two or more causative factors. Unfortunately, in many instances, numerous factors can be found. The real reason for this becomes apparent if the causative factors are traced to their sources of origin. For example, enlarged tonsils and adenoids are common causes of mouth-breathing in children. Mouth-breathing is a common cause of malocclusion and irregularity of the teeth. Malocclusion interferes with the self-cleansing of the teeth, prevents the normal massage of the gums, and allows the accumulation of tartar. The unsanitary conditions caused thereby predispose to decay and make dental work necessary. Decay, tartar, and dental work are the most frequent causes of pyorrhea. Individuals who have been mouth-breathers by reason of hypertrophied tonsils and adenoids are likely, therefore, to have, not only defective

Fig. 15.

Fig. 16.

Figs. 15-16.—Pyorrheal abscesses. These teeth are held more firmly in place by the remains of the alveolar process than those shown in illustrations 11 to 14.

Fig. 17.

Fig. 17.—Abscess at the root apex of a vital tooth. Tooth responded to all tests for vitality of pulp. The infection was derived from the gum margin. The anterior table of the alveolar process had been eroded as far down as the apex of the root.

teeth which are prone to cause pyorrhea, but also hypertrophied infected tonsils which may lower resistance to infection and which in this way increase the susceptibility of the gums to infection. Such individuals are also likely to have one or more systemic diseases as a result of acute or chronic tonsillitis, which may cause an additional lowering of resistance. All of the above factors singly or combined may play important parts in the pathogenesis of pyorrhea. In the average medical case, not one, but several predisposing factors can usually be found.

Infection is seldom or never a sole cause of pyorrhea. Pyorrhea would seem theoretically impossible, however, without infection as a primary cause. Malocclusion, defective dental work, etc., might cause pressure atrophy of the

gum and alveolar process, but could never cause the chronic inflammatory changes of pyorrhea unless infection were superimposed.

The *microorganisms* found in septic pockets about the teeth are numerous and varied. If the superficial pus in pyorrhea pockets is removed and examined, a great variety are found coexisting; namely, streptoccocci, pneumococci, diplococci, staphylococci, bacilli, spirochetes, and amebæ, of various sizes and strains. If the superficial pus is wiped away and a culture or smear is taken from the deeper areas, the members of the streptococcus and staphylococcus group are found most constantly. Streptococci usually predominate in numbers and are often in relatively pure culture. Streptococcus viridans, streptococcus hemolyticus, and amebæ can be demonstrated in almost every case, and a few colonies of staphylococcus aureus and albus in the majority of cases.

It seems improbable that any individual organism plays a specific role in

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

Figs. 18-21.—Illustrate the ill effect upon the alveolar process of careless dental work.

the pathology of the disease. Many of the organisms which can be isolated are pathogenic and capable of causing acute or chronic inflammatory change in many tissues under favorable conditions. One doubts, however, if any of them ever gain a foothold in the tissues of a normal healthy gum, and cause local disease unless the resistance of the gum against infection is lowered by some coexisting abnormal condition. In fact, one might be justified in believing that if a pure culture of bacteria obtained from a case of pyorrhea were applied directly to the gum, the bacteria would probably be washed away and killed by the secretions of the mouth, and do no harm unless the gum had been previously rendered susceptible to attack by local injury, lowered resistance, or both combined.

A spirillum associated with a fusiform bacillus found in great numbers in Vincent's angina is perhaps worthy of special mention. These organisms are

found in small numbers in pus expressed from pockets about the teeth and tonsils in normal individuals. They are occasionally found in overwhelming numbers and in almost pure culture in cases of severe rapidly advancing pyorrhea. This type of disease may progress with great rapidity, and may cause rapid destruction of the soft parts and alveolar process even in patients with relatively normal teeth and gums. It is more commonly observed, however, in individuals in whom irregularity of teeth, tartar, defective dental work, or careless habits render the mouth unsanitary. This disease usually yields rapidly to local treatment.

The presence of amebæ can be demonstrated in the vast majority of chronic lesions of the gum. They are often present in great number, especially in the deeper pockets. This discovery led Bass and Johns to suggest the use of emetine in the treatment of pyorrhea. It is difficult to determine whether or not

Fig. 22.

Fig. 23.

Fig. 24.

Figs. 22-24.—Illustrate the ill effect upon the alveolar process of careless dental work.

amebæ play an important role in the pathology of pyorrhea or whether they are harmless secondary invaders. It appears true, however, that emetine has a certain limited sphere of usefulness in therapy. Its effect is not permanent, however, unless the mechanical and sanitary condition of the mouth is properly cared for.

Temporary trauma, such as might be caused by an acute injury or by the use of toothpicks or toothbrushes and by the irritating effects of tobacco, is perhaps never in itself a cause of pyorrhea in healthy individuals with regular, clean teeth. Temporary trauma may be a contributing cause of minor importance, however, in patients with unsanitary oral cavities.

Chronic irritation and repeated trauma of the gum, and unsanitary conditions due to tartar, decay at the gum margin, poorly constructed fillings, crowns and bridges, malocclusion, irregularity of the teeth, etc., are among the

most important and most frequently observed causes of pyorrhea alveolaris. If teeth were all regular and kept clean, and if dental work was always properly constructed, pyorrhea would be a relatively rare disease.

Pyorrhea due to the above causes is likely to occur in localized areas of infection at first. It is found frequently under defective fillings, crowns and bridges, and in such locations there may be extensive destruction of both gum and alveolar process. Later the infection is likely to become more general.

Fig. 25.

Fig. 26.

Fig. 27.

Fig. 28.

Fig. 29.

Fig. 30.

Figs. 25-30.—Illustrations show deposits on neck of roots. In some instances there appears to be bone proliferation of the root due to chronic irritation of the peridental membrane just below the gum margin.

It hardly comes within the scope of a medical man to say more concerning this purely dental problem.

Lowered resistance to infection has an important bearing upon the development of pyorrhea. Dentists who neglect this factor are likely to have a number of failures in their efforts to cure pyorrhea. Resistance may be lowered

by the following diseases to such an extent as to render the gums abnormally susceptible to infection:

First, by constitutional conditions, such as diabetes, pregnancy, lactation, alcoholism, debilitating diseases, blood diseases, anemia, diseases of the ductless glands, lead poisoning, and scurvy, and by the therapeutic use of mercury and potassium iodide. It is well known that pyorrhea frequently starts and advances rapidly during pregnancy and lactation, especially in individuals with defective and unsanitary oral cavities; also that pyorrheal sepsis, like other

Fig. 31.

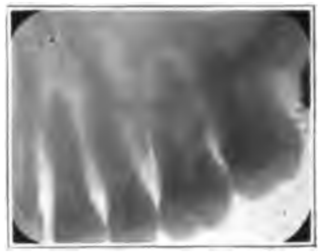

Fig. 32.

Fig. 33.

Fig. 34.

Fig. 35.

Fig. 36.

Figs. 31-36.—Typical example of oral sepsis in a patient with a great deal of dental work. Hardly a tooth can be found which is not the site of infection. Note the exostoses of the roots shown in Fig. 31 due to chronic irritation of the peridental membrane.

forms of sepsis, is likely to occur in patients with diabetes, anemia, etc. The reason is that the defensive mechanism in patients with these conditions is definitely reduced in its power to combat infection so that they become fit subjects for pneumonia, tuberculosis, furunculosis, pyorrhea, and other infections. Such patients may combat infection normally if the systemic condition is relieved. A case of acute superficial pyorrhea observed in a patient with diabetes who had

regular, normal teeth, cleared up without local treatment a few days after the urine was rendered free from sugar.

Second, resistance against infection may be lowered by infection. It may be lowered by the more localized infections, such as tonsillitis, alveolar abscesses, infected nasal sinuses, cholecystitis, appendicitis, etc., and by the more generalized infections such as typhoid fever. The bearing which infection in distant organs may have upon the development and course of pyorrhea is important and often striking. Pyorrhea is sometimes noticed first or apparently cured cases recur soon after an attack of tonsillitis, or after the development of an acute alveolar abscess, or after a sinus or gall bladder infection. This is especially true of individuals with unsanitary mouths. It may be attributed to the fact that resistance is lowered by the acute infection to such an extent that the organisms about the teeth flourish, invade the tissue of the gum and cause local inflammation. Analogous examples of exacerbation or recurrence of apparently healed inflammatory processes after the development of acute infections are commonly met with in the practice of medicine. It is a common occurrence, for example, for latent tuberculosis to become active after an attack of bronchitis or acute tonsillitis. Chronic appendicitis, cholecystitis, or a chronic latent Neisser infection may undergo an acute exacerbation during or following acute bronchitis or tonsillitis. Urethritis that has been clinically well for months has been known to recur after an attack of la grippe. A healing furuncle may discharge more pus or the scars of recently healed furuncles may itch, become red and even discharge pus after the development of a fresh furuncle or after an attack of tonsillitis. A patient we observed who had specific disease which had been latent for four years had an extensive papillary brown-red rash and gave a positive Wassermann test one week after recovery from typhoid fever.

The above examples are mentioned to illustrate the fact that resistance against infection may be lowered by infection. It may be lowered either by focal infections or by the more widespread infections. For this reason, alveolar abscesses, chronically infected tonsils or adenoids, infected nasal sinuses, chronic appendicitis, chronic cholecystitis, and other chronic infections may be insurmountable obstacles to the permanent cure of pyorrhea by local treatment alone. The gums may improve and remain healthy so long as the teeth are kept scrupulously clean and free from tartar, but so soon as the hygiene of the mouth is neglected and resistance is lowered by fatigue, exposure to cold, indulgence in alcohol, etc., increased activity of some chronic infection may cause a further lowering of resistance and the lighting up of a latent infection of the gums. Chronic foci of infection are frequently contributing causes of pyorrhea and frequently render its permanent cure difficult.

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EDITORIALS

The Need of a National Dental Board of Registration

FOR a number of years a few men in the dental profession have realized that the present plan of registration of dentists by individual state boards does not possess all of the advantages that are desired by the profession as a whole. Under the present conditions, the registration of dentists is controlled by the state board of each state, with the result that a man may be qualified to practice dentistry in one state, and by not fulfilling requirements of the board in another state, he is prevented from going to a different field to practice, although conditions seem more favorable for him to make the change.

We realize that according to the present law, each state can make whatever restrictions it desires in regard to the registration of men engaged in the practice of dentistry. This is based upon the old question of "state rights," but we believe that such important bodies as the medical and dental profes-

sions should not be subservient to the individual "state rights" or state laws, but should be governed by a national dental board of registration which would have the same plan, laws, and regulations governing the entire medical and dental professions of the United States. We are aware of the fact that under certain conditions state boards have made concessions under the term of "reciprocity," which have some advantages and which have a great many disadvantages. There are certain states in the Union that are very much opposed to dentists from any other locality coming to those states to practice. In such states we find the dental boards have refused to make reciprocal arrangements with other boards. In fact, the state dental board has taken upon itself the function of protecting the men registered in the state against too large a number of men being engaged in the practice of dentistry. In some instances state boards have attempted to build up lines of restriction which would prevent anyone from being permitted to practice in the state unless he is a native son or graduate from a certain school. This may be a satisfactory arrangement so far as the men already registered in the state are concerned, but it is a very small, selfish, and unsatisfactory plan in relation to the dental profession of the United States as a whole.

Again we see the need of a national dental board of registration as a result of conditions which have been produced by the war. We find men in the dental profession, from all localities who have given their service to the country, with the result that there are a great many dental offices vacant, and in some communities the number of dentists has been so decreased that there are not enough left to take care of the public. We find some instances where a man who joined the army has been desirous of having some one in his office to take care of his practice while he is away, and the man he desired to bring into the office is not registered in that state. Consequently, his dental practice has been left without anyone to take care of it, simply because the dental laws of the United States are so arranged that a man who is registered in one state is not permitted to occupy an office in another, even though the man who owns the original office is rendering a service to the country by giving his time to the army or navy.

We have known of several instances in which men engaged in the practice of orthodontia have given up their practice to join the army, and have attempted to get orthodontists from other states to take care of their practices while they were gone; but, of course, were prevented from doing so by the state boards. These men who have given their services to the country may be away from their offices for a number of years; and as a result of having no one in the office, their practice will be in bad shape when they return.

In other instances men in the army and navy may desire to change their location when they return to civilian practice due to the fact that it will be practically as easy to build up a practice in one locality as it will be to build up a practice by returning to their old location. We believe that out of fairness to those men who have given their service to the country, some provision should be made whereby they can locate in any community they desire, even though it be in a different state than the one in which they formerly practiced. We realize this matter is going to be very difficult to arrange with the present

system of individual state boards. With a national dental board the matter could be very easily arranged. We have never been able to see why a man who is qualified to practice dentistry in one state is not qualified to practice in another. The only possible reason we can find for the existence of a number of state boards is the old question of state rights, plus the fact that each individual state board has a very exalted opinion of itself and believes it occupies a very important position in the dental profession, along with the political preference which the board gets by its existence.

We believe a great step will be made in the advance of the dental profession as a national institution when state boards are eliminated and the registration of dentists is placed under one national board and probably controlled by the Surgeon-General's office. We have given this matter much thought in times past, and can come to no other conclusion except that a national board of registration will be a decided advantage over the present plan of individual registration in each state by local state boards. We hope that we may see the time when such a board will be a certainty, and in existence, rather than a need and a desire.

Cast Inlay Suit Lost by Plaintiff

ANOTHER chapter has been written in the case of the cast inlay patents, which has been a vital question before the dental profession for a number of years. Over three years ago suit was filed in Chicago against 535 dentists, and injunctions were obtained against about 118. Some of these men were prevented from making inlays entirely, while others had to file a $500 bond during the decision of the case. As a result of these suits, the Dentists' Mutual Protective Alliance was organized to contest the patent. After being in court over three years, a decision has been handed down which is a complete victory for the Alliance, and the court has failed to grant the plaintiff any of his contentions. The case involved 43 claims made on four different patents, and the court fails to grant any of these claims.

In contesting a patent, in order to render it invalid, evidence must be shown that the particular thing was not new at the time the patent was obtained. In order to substantiate its claims, the Alliance presented four different cases to show that cast inlays had been made according to the method patented before the patents were granted. In handing down the decision, the court only mentions one case, that of Dr. Philbrook, of Iowa, against which the plaintiff's attorney offered no evidence. By this action the attorney practically admitted that Dr. Philbrook did what he said he did at the time mentioned. Consequently, in handing down a decision, the court selected only this one case, as it was sufficient evidence to show that inlay patents were invalid according to priority.

The litigation in this suit has been very expensive; however, should other suits be filed in different districts, they can be defended for a much less amount, due to the fact that the court has selected the Philbrook case as sufficient evidence to prove that inlay patents do not include anything new and original. Should suit be filed against a member of the Alliance in another district, it can

be defended for a comparatively small sum compared to what the three years' litigation has cost the Alliance in the present case.

The importance of this decision to the dental profession is probably very little appreciated, and the fight that the Alliance is making for the profession did not receive the support to which it was entitled. As a result of this decision, the dental profession has been saved at least $5,000,000, besides enormous amounts of trouble involved in suits, injunctions, and possibly jail sentences. The decision of the court in this district will not prevent the filing of suits in other districts, therefore, there is still a need for the Dentists' Mutual Protective Alliance, and still a need for members to protect themselves against the inlay patents, as well as similar conditions which may arise in the future.

The plaintiff's attorney has a few weeks in which to appeal the case; and, due to the enormous amount involved in royalties, it is very probable that the case will be appealed and carried to a higher court. However, from the complete evidence submitted, we can see very little chance for reversal by a higher court.

The X-Ray in Dentistry

DENTAL practitioners are frequently heard to remark that the practice of modern dentistry has become so very exacting, and the responsibilities of failure so great, that all pleasure in the conduct of a dental practice has completely vanished. It is argued that a thoroughly conscientious dentist, in the light of present day knowledge, carries a heavy burden because of the possibility of a patient being dismissed with local dental foci of infection, which may result in very serious illness or even death. Observation, however, leads to the conclusion that many who are thus "worried," have almost entirely ignored that most important dental office requisite, the x-ray. Little wonder the conscience is troubled, because of the uncertainty of results and the knowledge that every known device has not been used to render the most skillful service possible.

We make no extravagant claims for the shadow-picture machine. It is not infallible. But for checking up root canal treatments and fillings, it is, to our mind, quite indispensable. What justification has any dentist for charging a patient for the most skillful service, and yet continue filling root canal after root canal, without knowing they are properly filled, and failing to take advantage of every possible means to learn the facts?

Those dentists who regularly use an x-ray machine have established a new and better standard of service. The conscious knowledge of having rendered the best possible service, results in the real joy and pleasure, without which dental practice is nothing but a grind. The practice of dentistry today certainly involves greater responsibilities, but it also involves better service and more satisfying results. If an x-ray machine were used for nothing else than producing skiagraphs of root canal fillings, it would more than justify its use, in pleasure and satisfaction to the dentist.

At the outset, the x-ray should be recognized as a dangerous machine when in the hands of a careless or ignorant operator. Before undertaking its use the

operator should give special study to the whole subject and thoroughly master the technic of operating the particular machine employed.

It should also be recognized, that if an intelligent conclusion is to be arrived at, the significance of varied degrees of shadows, or the absence of shadows, are not of themselves to be taken as conclusive diagnostic evidence, but must be considered along with all of the clinical facts in the case. In other words the x-ray, while a most valuable aid to diagnosis, is only one of the links in the evidence, and is only of value when considered as such.

For diagnosis, studying rarefied areas, and the intelligent practice of modern dentistry, the x-ray has made for itself a permanent place in dentistry. Why not recognize the fact before your patients commence asking you,—Why?—*Oral Health.*

National Association of Dental Faculties

The next annual meeting of the National Association of Dental Faculties will be held in the Green Room of the Congress Hotel, Chicago, Ill., August 2d, at noon. The executive committee will meet at 10:00 A.M. on the second. The meeting will continue through August 3rd.

N. W. corner 10th and Troost, Care K. C. Dental Col.

CHARLES CHANNING ALLEN, *Sec.*, Kansas City, Mo.

Meeting of American Society of Orthodontists

The eighteenth annual meeting of the American Society of Orthodontists will be held August 1, 2 and 3, at the Edgewater Beach Hotel, Chicago, Ill. This will be an excellent meeting. It is advisable to make your reservations early.

Applied Anatomy and Oral Surgery for Dental Students*

THE second edition of this valuable work by Dr. Ivy follows out the same plan as the first edition which begins with a chapter dealing with the subject of applied anatomy. The work is extremely valuable from the standpoint of the student, owing to the fact that there is a set of questions at the end of each chapter which is of great assistance to some in studying the text.

Chapter I deals with the study of the various bones of the head and the face from a surgical standpoint. The muscles, blood vessels and nerves are taken up in a similar manner and the description of each is very concise and complete.

There are also chapters dealing with inflammation, surgical fever, shock, collapse, hemophilia and anesthesia. The work to a certain extent is a combination of pathology and surgery which makes it very valuable to dental students, and we know of no book which would fill such an important place in dental education and no work whereby the student can obtain as great an outline of the subject in so short a time as can be obtained by Ivy's "Applied Anatomy and Oral Surgery."

*Applied "Anatomy and Oral Surgery," 2nd edition, thoroughly revised by Robert H. Ivy, M.D., D.D.S., Assistant Surgeon, Columbia Hospital, Milwaukee. Former Assistant Surgeon, Pennsylvania Hospital, Former Instructor in Oral Surgery, University of Pennsylvania. Second edition, 290 pages, illustrated, published by W. B. Saunders Co., Philadelphia and London, 1917. Price cloth, $1.75.

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ORIGINAL ARTICLES

ORTHODONTIA IN THE YEAR NINETEEN HUNDRED EIGHTEEN*

BY B. FRANK GRAY, D.D.S., COLORADO SPRINGS, COLO.

I BELIEVE it may not be time misspent to consider for a few minutes, some of the beginnings of our work as a specialty. One does not need to assemble a thousand instances of the sometime efficient, and more often crude methods resorted to for the correction of malocclusion of the teeth, even so recently as to be quite within the recollection of those present. A bird's-eye glimpse over that long period will at least cause anyone to reach the conclusion that chaos reigned. But out of it all there was to spring better things. Indeed that era furnished the soil from which grew a fairer flower than had blossomed before.

Until Angle observed, thought, practiced and finally furnished a simple classification of malocclusion of the teeth, certainly little progress had been made in making of orthodontia either an art or a science. We know science is concisely defined as "systematized knowledge." Certainly there was not an abundance of "systematized knowledge" as applying to our work prior to Dr. Angle's teachings. If it is complained his work did not constitute of orthodontia a science, in the strictest sense of the word, I reply that in the affairs of mankind there is little that can be wholly scientific in the sense, for instance, that mathematics is a science. There we have absolute knowledge, systematized, exact, and unvarying from a perfect principle.

Again Dr. Angle simplified and correlated appliances for bringing about the correction of malocclusion of the teeth. Whatever the objections to his earlier appliances, it is to be remembered that until he taught classification and the use of the expansion arch in the work of correction, orthodontia received little impetus. Only at that time did it commence to take its place seriously as a real department of dentistry.

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., Feb. 18 and 19, 1918.

Every progressive man avails himself of the thought and work of others, perchance contributing something of his own that may be original. But credit is always due the man who best sifts the wheat from the chaff, utilizing what is worthy to the upbuilding of a method or a science that shall bring a vast amount of good to the world. And lest it be carelessly said that Dr. Angle was content in the conceit that his earlier appliances were beyond improvement, it is recalled he has incessantly labored for their betterment, indeed to the point of adopting those which contemplate entirely different principles of tooth movement. A sane tolerance would grant to any man, whether he be of one school or of another, the credit due him because of his own well-wrought work. Every time-tested improvement of classification, or advancement in mechanical procedure, should be allowed to fall into its proper channel and receive its due recognition. But the test of time does not always fulfil the *encomiums* of the moment! Witness some of the impossible mechanical contrivances being offered for orthodontic treatment even today.

Before the era of specialization, the use of jackscrews, rubber plates and mechanism most intricate and uncertain in its working, held sway. Under the new regime, simplification and standardization of methods have been sought and attained in a measure not secured heretofore.

It is true not all men of recognized ability in the practice of orthodontia choose to accept and make use of some of the newer appliances, in the belief they may do better with the older ones, or with modifications of them. However, new standards have been set, higher principles defined, and those with the intelligence, the will and the requisite skill, need not go far astray in their efforts at the successful correction of malocclusion of the teeth today.

There have come to the attention of orthodontists within the past couple of years, certain mechanical methods for the determination of the normal dental arch. These methods have elicited some attention among our coworkers in the eastern part of the country. While I believe the science of mathematics may be an aid in the formulation of a principle from which to work, I would not think mechanical engineering plots or surveys as employed in the methods cited, would be a safe and unvarying guide in orthodontia. We are not dealing with blocks of wood or stone, the harmonious relation and placement of which depend upon the gauge and compass. We are concerned with vital tissues,—parts of human beings,—with the teeth and their investing structures. Insofar as a hard and fast mathematical formula may direct the orthodontist to a general principle of procedure, just so far and no farther may these methods be valuable.

In the saying of it I may lay myself liable to a bit of ridicule, but I would be interested to know how many specialists in orthodontia share my opinion, in part or in whole? I have the belief, with the knowledge of malocclusion I possess in common with many other men, and the experience I have in its correction,—that my own sense of proportions and of the harmonious relation of the teeth, of the dental arches and of the human face,—constitute a guide maybe as trustworthy as that which may be formulated through mechanical diagrams of the kind mentioned.

What of art as related to orthodontia? Certainly the best teaching in

orthodontia, can not ignore art as an essential. Does the artist depict on canvas his wonderful conceptions of the human form—so ideally beautiful in every harmonious line, because of his resort to mechanical engineering? Did Michelangelo and Leonardo da Vinci chisel and paint their way to undying fame because of the aid of mechanical formula? I think not. Neither do I believe the successful practice of orthodontia to be specifically dependent on such devices. A knowledge of architecture and mathematics may have contributed to the splendid sense of harmony and of proportion these eminent men possessed. A similar knowledge might aid the orthodontist in the same way.

Again, I do not believe I am alone in my personal experience when it comes to a resume of my work through a good number of years. As I look over the cases it has been my pleasure to treat, I have observed and heard of few, if any, absolute failures, and certainly there have been many tolerably good results. There have been few displeased parents or guardians, I think. My successes have come through an unceasing persistence of effort, and the failures, in whatever degree, have largely resulted because of contingencies which no amount of mathematical formula would have overcome. I refer to mouth-breathing, lip and tongue habits, maturity of the patient treated, etc. Outside these cases there may have been a few where I have failed to meet the occasion through personal inability. But frankly, I feel their number has been tolerably small. I make this rather personal statement for the purpose of illustrating what I feel to be a truth that is too much overlooked; namely, *There is no Royal Road to Success in the Practice of Orthodontia!* There probably never will be, in the common meaning of that expression. Only through conscientious, intelligent effort, and love for our work, can we obtain really good results. The tissues with which we deal, and the forces which resist our efforts, are a part of the complex life problem itself, and as such their treatment is not subject to the rigidly exact methods of the mathematician.

I note an impatience at waiting for results. The wearing of appliances through long periods of time *is* a bit deplorable, but we may not hope to accomplish in three months time what nature would require three years to do! Undue haste augurs an unhappy result of efforts expended.

But to revert to the subject of the preceding paragraph,—it lessens our weariness if we can bring ourselves to a realization that true progress does not come through an uninterrupted series of successes. Today the attention is focused on some wonder-working appliance, method or theory, which promises to revolutionize our practice. It is adhered to more or less tenaciously, sometimes dependent a bit upon the persistence of its originator or chief advocate. In due course it may be wholly discarded or superseded by something else. Or, perchance, it may be adopted in part. But out of all this most interesting zigzagging, a scientific standard or method is more nearly approached, maybe, than ever before. Who then shall say, when viewing the matter in this broader way, that any really conscientious effort is really wholly wasted?

I have not failed to note in the record of a recent meeting of orthodontists, the president of the society stated it took him ten years to unlearn what he learned in six weeks,—referring to certain teachings he had received in his specialty. His statement was sufficiently amusing (for whatever reason) to

produce laughter in his audience. His admission presupposes an unusual susceptibility to the instructions of his teacher. I am very positive his instructor has all too often regretted he wasted any time with a student, who has felt himself so handicapped as a result of receiving the best teaching in orthodontia the world afforded at the time. It is worthy of note he stands quite alone in his estimate of the instructions to which he refers.

The question of orthodontia schools has been receiving no small amount of comment, both before societies and among specialists as they meet from time to time in social diversion. I wish here to record my great gratitude for the teachings I received in the Angle School of Orthodontia. I think I have observed about as closely as anyone the status of other courses in our specialty, and I have yet to know of a student of these more recently established schools who I believe has received benefits equaling those received by the majority of the students of the Angle School of Orthodontia. It is admitted, as a matter of common reason, that any course of instruction given today might have the advantage of the progress of the past few years, much of which progress is again traceable to Angle's work since the closing of his school.

Apropos of the last view expressed, some of the greatest institutions of learning in the world today, existed and taught theories, methods and practices years ago which might appear ludicrous today. Still those institutions have the respect of mankind and the love of their alumni. They are ever alert to present the best courses of instruction the times produce.

So I feel that nothing short of pure personal animus, having its roots in some unfortunate differences of opinion or temperamental considerations, could cause any man to make statements such as were made at the meeting of orthodontists I have referred to. Not only are such statements in extremely bad taste, as directed against the first president of the society where they were expressed, but in a way they impugn the standing of many of the leaders in the practice of orthodontia in the world today. I am sure I will be supported very generally in the opinion that such remarks rebound to their author's own disparagement.

But I am sure there is no need for discouragement. Our work is advancing,—if not always in a straight line, then by the zigzag course I have alluded to. Little more may be said of any other scientific endeavor. Perfection is so high an attainment that we may scarcely hope for more than a little nearer approach to it as the years go by, and then only through the best efforts of all striving toward the one common goal.

DISCUSSION

Dr. Wm. Cavanagh.—Certain great things have been accomplished in orthodontia, and many must have contributed to our present sum total of knowledge. There have been certain leaders who have been recognized, and certain basic principles have been laid down in our practice which can never be disputed. Time has gone on, and they have been proved. We must admire and must honor those minds which have made our present position as a specialty possible. We should overlook personal matters. All great men have certain characteristics we can admire. I will ask this society to forget personal jealousies and remember the contributions of one prominent orthodontist, and recognize in him the mind of a master. I refer to Dr. Angle. I think no man has ever accomplishehd so much as he in the systematizing and elucidation of the basic principles on which our work is founded. We

should recognize the fact that Dr. Angle today takes much the same position in orthodontia that Dr. G. V. Black occupied in general dental practice, and which the Mayo brothers occupy in surgery. He has been the leader, and has placed the specialty of orthodontia on a sound basis.

Dr. James D. McCoy.—Mr. President and Members: A good many points have been covered in Dr. Gray's paper which we could perhaps discuss at length with profit. I have been particularly interested in all his remarks, because he has expressed (if I may state it in that way) my own sentiments very, very thoroughly, and has done so in much more beautiful language than I might have used.

I am interested in his reference to the survey of the dental arches, because this subject has occupied more or less of the attention of orthodontists during the past year. I believe Dr. Gray has summed up the situation in a very logical way in his remarks.

Following the last meeting of the American Society of Orthodontists I was interested in reading in a report of the meeting, the remarks of the president of the society, which Dr. Gray has quoted. I am sure my opinion of the statement made by Dr. Federspiel would not look at all well in print.

I believe all the great principles we use in our specialty were originated by Dr. Angle. At least he has placed them before us in a manner so that we can utilize them, and I believe orthodontia has received its very greatest impetus through him and through the establishment of his school. I believe if we go back and follow out the results of that school we will find, even though we might not consider the course of instruction then given, as perfect today—we must acknowledge that Dr. Angle was able to instill a wonderful degree of enthusiasm into his students, and they still maintain that enthusiasm even years after the school has been discontinued.

I shall not attempt to discuss any of the other points touched upon by Dr. Gray. I think I have at least expressed myself rather forcibly on one feature of the paper.

Dr. John R. McCoy.—I thoroughly approve of Dr. Gray's remarks, particularly where he speaks of the honor that is due the great man that has brought order out of chaos in orthodontia.

Dr. H. L. Morehouse.—I wish to express my appreciation of Dr. Gray's most able paper. As Dr. James McCoy has said, I think he has expressed the sentiments of us all in a most comprehensive manner.

I also was glad he brought out the matter of the survey of the dental arch because, while I have not gone into it definitely, I have felt we could not treat our cases from the mathematical standpoint. We might possibly get some idea as to the size of the arch, but outside of that I have not been able to see wherein it would be of any great aid in our work.

As to the Angle School of Orthodontia, certainly I feel most of Dr. Angle's students were able to grasp the fundamental principles taught there. and that they have been able to apply them successfully is attested by the many successful specialists in orthodontia in the country today who received their first real training in his school.

I think we should strive not to be narrow, and ever be appreciative of the principles Dr. Angle taught us. These principles have proved their worth, and they can not be cast aside.

Dr. Mann.—It does not seem to me anyone who has not had the advantage of the course in the Angle School of Orthodontia, can appreciate the opportunities afforded its students for gaining an understanding of the fundamental principles upon which this science is based. In my own case, I approached the course with a great deal of misunderstanding. It had been my thought that the course of instruction would embrace very largely mechanical principles. But after eight weeks spent in that school I not only returned home with a different understanding of orthodontia, but also with a clearer and better conception of the general science of dentistry. Albeit the nomenclature of Dr. Angle is as simple as any person could devise, it embraced everything necessary to clearly signify the conditions as we find them in individuals. The knowledge of occlusion, of normality according to type as he taught it day after day, has given me personally—and I feel others, who had the advantage of the course—a clearer and better understanding of all things pertaining to the oral cavity.

Dr. Gray has read one of the ablest papers I have listened to in a long time.

Dr. Allen Suggett.—In reference to the surveying instrument of Dr. Stanton. He sent out here to the Dental Congress in 1915 a number of slides, together with his paper. The models he sent were indeed very beautiful, and we were much interested in his work. I never have made up my mind as to just what use it is going to be to orthodontia, although it seemed to me a wonderfully scientific way of determining the least movement by which

one could place the teeth in occlusion. Whether practical or not in use, I do not know, but I still feel it is very scientific and most accurate. Evidently much time and study has been given the method.

Referring to the discussion as to Dr. Angle, as time goes on I am sure the petty things that have marred the association and friendships among orthodontists will be forgotten. There is no question as to the lead Dr. Angle has taken in the specialty of orthodontia, nor as to the scientific principles he has laid down. Neither is there any question at all as to the enthusiasm with which he imbued his students and followers, and I believe it would be more their fault than his if these small things were allowed to be perpetuated. I think in all these matters (and I would include the remarks which had reference to the president of the American Society of Orthodontists) that the way to make progress is to be more gentle, more open-minded and more indulgent of the other fellow. Someone has said that to understand was not to criticise. Another said, to thoroughly understand, there was nothing to criticise. So that I think, as time goes on grievances will disappear, and it is up to all of us to endeavor to discourage them. We certainly will always remember the splendid accomplishments of Dr. Angle, and the basic principles he has advanced which have never been approached by others.

Dr. L. E. Carter.—I think Dr. Gray's paper has brought to our realization some appreciation of what specialization will do in any particular line of work. He has referred to what has been accomplished in orthodontia since Dr. Angle introduced it as a specialty. With reference to the different schools of orthodontia, I can not imagine a man's head being so hard it would take ten years to seep out of it what could be driven in in six weeks, and if it could be driven in in six weeks it is a pretty good recommendation of Dr. Angle's School.

I believe Dr. Angle's name and orthodontia will always be practically synonymous. His scientific attainments and what he has done for orthodontia should entitle him to the credit for having made the specialty what it is today.

With regard to these engineering surveys or plots of the dental arches, I think that Dr. Gray hit the nail very well on the head, and I expressed myself yesterday as to my opinion along that particular line. I may remark again that I do not believe we can treat a human being like we can a steam engine.

Dr. Scott.—Regarding Dr. Stanton and his engineering principles as applied to orthodontia. About a year ago I had the pleasure of spending all of one day with Dr. Stanton, and with his engineer, Mr. Fish. Mr. Fish is not a dentist, but is a civil engineer if I remember correctly. He takes a model of the mouth where malocclusion is present, and surveys this model scientifically and correctly. Of that there is no doubt. He plots upon tracing paper with scientific instruments the teeth in malocclusion, and then from this he measures scientifically the diameters of the teeth above the gum lines, contour of the rugæ, hard and soft palate, and plots them in occlusion. Up to that point it is all right as I see it, and I followed him as closely as I could, and as closely as my knowledge of mathematics would permit. From this point on he tells you just how far and in what direction, be it labially, buccally, mesially or distally, or in any direction, each and every tooth must be moved in order to establish the normal occlusion. As I see it, that is all right, but he does not take into consideration the median line of the face. Now you know, and we all know, that the definition of normal occlusion should be made to read something like this: Normal occlusion is the normal relation of all the inclines of the teeth, not only at rest but also in function. You may take the most beautifully occluded teeth you can imagine and they will occlude at rest, but not in function and then there is not much value to it, as they will not stay at rest.

What we are trying to do at least, is to establish a first molar index,—getting the position of the upper first molar in relation to three planes of the face. These three planes are, the plane of Frankfort, passing through the eye and ear; the median plane, passing through the nose and external occipital protuberance and the third plane, passing from ear to ear. If we can establish the relation of the upper first molar in relation to that, we would have something from which to work. The upper first molar is a very hard tooth to move distally. Perhaps someone here can tell us how to do it, but I can not do it. Dr. Stanton surveys the models, and tells you just where to move the teeth, but he does not tell you how to do it. Unless he does that, his plans are not of great value.

Dr. Gray.—I wish to thank you all for the generous discussion accorded my paper.

PRESIDENT'S ADDRESS BEFORE THE PACIFIC COAST SOCIETY OF ORTHODONTISTS*

By Wm. Cavanagh, D.D.S., Portland, Oregon

It would seem but logical that upon the occasion of these annual meetings of our society, the trend of thought outlined in the presiding officer's address would be largely toward a consideration of the progress made within the profession of orthodontia during the year; and an analysis of these causes which prohibit our more rapid development. In other words, to turn the x-ray of self-inspection upon our accomplishments and limitations in the hope that it may assist us in materially increasing the former, and eliminating the latter.

In thus reviewing the cause we represent, we find much that is gratifying, but nothing to warrant us in proclaiming that we should be content with our present status.

It is highly improbable that orthodontia will ever become what is termed an exact science, inasmuch as, while man has developed certain exact sciences, none of them apply to his own being. He is too variable a quantity.

We will, however, have approached much more nearly to this ideal when the light is more fully thrown on certain obscure factors in the etiology of malocclusion, and I feel that I express quite accurately the state of mind of our profession when I assert that the next great advance within our ranks must come as a result of investigation in this field.

From our inability to differentiate between those cases which are susceptible of successful treatment, and those which are not, arise practically all of our professional woes, and to eliminate them will require a more intimate knowledge of the causes of malocclusion than we now possess.

Our failures occur, not from any deficiency in the available technical knowledge necessary to obtain normal occlusion, but rather from the lack of understanding those forces which operate to destroy the results obtained, possibly, after many months, and perhaps years, of painstaking effort.

Somewhere, I have read that orthodontia is, or should be, nine-tenths scientific and one-tenth mechanical; but it is obvious to us all, that we are developing in inverse ratio—that we are becoming top heavy with mechanical devices and systems, while much of the scientific base upon which we are supposed to have builded, is still unproved.

Of recent years, we have had wrought out, and placed at our disposal by the master minds of our profession, certain highly efficient and refined appliances, by means of which any competent orthodontist is capable of producing normal occlusion of the teeth, where such occur in normal number and size.

With retaining devices, we are sufficiently familiar to maintain normal occlusion so long as we depend upon that mechanism. But who among us does not remove such retaining appliances from certain of his patients, in fear and trembling that he may possibly be furnishing the teeth, so released, a return ticket,—and why?

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., February 18-19, 1918.

Because the science of orthodontia, and by that I mean its etiology, and especially the constitutional, congenital, and hereditary factors of malocclusion, are not fully understood.

It is true we can be reasonably positive regarding our statements as to the effects of abnormal breathing, of caries of the deciduous teeth, of retarded absorption of the roots of such teeth, of faulty dental restorations, and all similar local conditions; but it is not these which cause the necessity for the replacement of appliances long after we had a right to believe our work completed; but rather those unseen, and as yet, undetectable forces which operate to undermine our labors and our faith.

Intimation of the possible causes is given frequently in our literature in treatises dealing with the ductless glands, the pituitary bodies, with the diet, heredity, and so-called faulty cell metabolism. Yet of all that has been written regarding these, and kindred etiological factors in malocclusion, we still have not the diagnostic guide by which to determine those cases which are ultimately to fail regardless of the painstaking care put upon them, and the apparently perfect result once obtained.

Refinements of appliances will continue to follow, and we shall welcome whatever may, without sacrifice of efficiency, contribute to the greater delicacy, inconspicuousness, and cleanliness of such. But I still maintain, that at the present time all means essential to correct alignment of the teeth are available—with the devices within our reach; and furthermore, that since the discovery that bodily tooth movement is possible, no great advance in the treatment of malocclusion has been evolved.

There are those who contend that, until we plan the position of each tooth according to geometrical design, our work is haphazard and empirical, but since the human anatomy is not constructed by rule of square and compass, we must decline to give up the methods which are daily proving themselves to be of greater value; and if the genii of the profession will but turn their attention to the more elusive and abstract theories of etiology, and give the more humble of us an opportunity to perfect ourselves in the technic of such appliances as we now possess, Orthodontia will probably give them place among the immortals.

In considering the events of the past year in orthodontia, we can but be impressed with the important (?) part assigned our specialty on the program of the 1917 meeting of the National Dental Association.

On this program, consisting of approximately 135 numbers, we were honored by being permitted one appearance, surely a dental anomaly!

To even the lay mind, it must be evident that the profession of dentistry is based upon the necessity for the preservation of the occlusal relations of the teeth. That the entire purpose of its existence is that which the orthodontist has made his particular sphere of endeavor, and yet, his work was recognized to the extent of being accorded approximately 1-135th of the time of the national meeting.

Another flattering concession of the esteem in which our work is held, is given in the tentative schedule of studies as contained in the four year course in dentistry.

Out of a total of 5632 hours, but thirty-two have been assigned to instruction on the subject of orthodontia. This is exclusive of infirmary practice which is not essential to graduation.

The dental graduate is, then, without further preparation, permitted under our laws, to represent himself as an orthodontist.

This is a condition which surely needs rectifying. Either the scope of the course of study in the dental schools should be materially broadened, and more time allotted to its pursuit, or a special course given for those who desired to follow this branch of work exclusively. For in no field of dentistry can it be said more truly that, "a little knowledge is a dangerous thing."

In conclusion I would draw attention to the words of the President of the National Association regarding the narrowing influences of specialization.

We are fully aware that the tendency in following one line of work is to develop "cranks." We have them. Some inoffensive, and harmless, others obnoxious and detrimental to the welfare of our society and profession.

As appliances and methods of treatment appear in constantly increasing numbers, we are prone to adopt one as the only practical and efficient one, and to depreciate the efforts of a fellow-practitioner who may see fit to use some other, equally as effective in his hands.

The fact that the pin and tube appliance and the ribbon arch, or any other variation of this method of applying the same principle of tooth movement will accomplish wonderful results, does not necessarily condemn the plain arch of ten years ago as a relic of a past age in orthodontia.

The plain arch has as true a place in orthodontic practice today as it had when we knew no other. So, too, has the coffin split plate, and the Kingsley head gear and retractor, where indicated.

So let us broaden our vision and extend a little charity to those who may hold views radically different from our own. They may be striving as hard—yes, and as successfully as we.

Professional jealousy and the inclination to belittle the accomplishments of others in the same field of endeavor, will react upon our society, and bring dissension where, for the sake of advancement, we must have harmony and cooperation.

DISCUSSION

Dr. Robert Dunn.—Gentlemen: Our President has read one of the most able addresses in the history of this society. He has touched upon many things about which I have thought for several years. Possibly one point might have been mentioned, namely: How much credit is due orthodontists for what they have taught dentists with reference to occlusion? I hope you will thoroughly discuss this feature.

Dr. James D. McCoy.—The very lucid address of our President has brought up many points, all of which are worthy of our earnest consideration. As to the progress of orthodontia, I think he has not underestimated the value of the work of the past year. While no radical change has taken place, I believe we have all been working to the end that some of the newer methods which have been advocated have been given a rather thorough testing out. Personally, I have been working along certain lines faithfully, with the result that I have realized more satisfaction and more benefit from my practice during the past year than ever before. Dr. Canvanagh's reference to etiology I believe, is most timely. Without doubt that is the subject in orthodontia, which rather than being placed first has always been relegated to a place of secondary importance. Whether this is due to the fact that it is not well understood, or because our attention is called

by necessity to the practical questions with which we meet in every day practice, I am unable to say.

The teaching of orthodontia in dental schools of which our president has spoken, is a very important subject to orthodontia. Personally, I believe that orthodontia as it is taught in the average dental schools at this time, is rather more a menace to the students than it is a real benefit. I do not believe that infirmary practice,—the handling of orthodontia cases in the operatory by dental students should be allowed. That is a rather radical statement, but I think until this work is given a more permanent place in the dental curriculum, children suffering with malocclusions should not be placed in the hands of anyone whose training has been as limited as that of the ordinary dental student. I think the solution of the problem lies along the same lines as that which faces the man who teaches oral surgery. You can not quote many instances where senior or junior dental students would be allowed to do major operations in oral surgery. They might be allowed to assist the oral surgeon, but so far as turning over the actual work to the students I do not believe that would be done.

At the present time, the manner in which orthodontia should be taught in dental schools should be along these lines: The cases should be handled by the instructor in the presence of the students rather than have the students themselves attempt to do the work. I have observed the methods in vogue with reference to teaching orthodontia in several dental schools, and have had charge of this work in one school myself for the past twelve years. I do not believe it is just to the patients to treat these conditions of malocclusion of the teeth in dental schools unless you select cases very minor in character. One of the discouraging things to me in the orthodontia situation today is brought to my attention through some of the advertisements of companies making orthodontia appliances which I see in catalogs, dental magazines, etc. In many instances you will see advertised a large number of appliances which can have no appeal to any man possessing mechanical ability, as being anything less than pure junk. Looking through a catalog of one of the larger manufacturers recently I was appalled at some of the appliances they pictured as available, and they in fact offer to fit them to the models, with instructions to the dentists for carrying on the treatment of the cases. These appliances are bulky and ungainly and so crude it seems to me, it would be nothing short of malpractice to subject a patient to their use.

That brings up another point which does not apply to any one of us probably, but it applies to many men attempting to do orthodontia. I refer to the too often total disregard of the soft tissues. We should school ourselves to give much more attention to the care of the soft tissues during orthodontic treatment, and if we do this we must use appliances which are delicate, and whose force can be under control at all times. There is one protest I would like to make in regard to mechanical appliances, and that is the use of the clamp band. I hope I will not be considered ultraradical in the statement that I think the molar clamp band with screw on the lingual side should be relegated to the junk heap. Personally, I have not put on such a band for a long, long time, and hope I shall never put one on again.

I wish to speak of another point. We can ill afford to use any method or appliance which may be a factor in the disintegration of the enamel surfaces of the teeth, or act as a predisposing factor in caries. And with that end in view I think we should use appliances that will permit the patient to give the mouth adequate care. It is one thing for us to clean up the mouth of the patient in the chair, but if they only visit the office once a week, or once every month, the prophylaxis attention we can give them does not amount to a great deal, so far as the health of the structures is concerned. It is the daily cleaning the patients can themselves give, which determines the condition of the teeth when treatment is completed.

Dr. Solley.—Speaking of the care of the mouth during orthodontic treatment, I would like to ask some of the members present what they use where we have slight recession along the gingival border. This is not due to mechanical irritation from appliances, but where the patient visits the office only once every one, two or three weeks, there may be a slight accumulation of food particles every night and there may be a little acid reaction. I have had three cases during the past year that have given me considerable worry due to this recession. If there is anything that will help me along these lines, I will be glad to hear it. The last six months I have been using normal salt solution as a wash every time the patient comes to the office, and if possible, the patient uses it night and morning, and I have been able to get in all these cases quite a beneficial result as to the care of the mouth. In fact it has seemed almost indispensable.

Dr. H. L. Morehouse.—I was glad to note the special emphasis Dr. Cavanagh placed on the question of the etiology of our cases. I have felt, for a good many years, that therein lies the real solution to the final perfection of our work. Like Dr. Cavanagh, I think we have sufficiently perfected our mechanical devices for the present to meet the requirements of treatment in all classes of orthodontic work. But the question that is vital now is that of permanency of result, and the question of permanency in my mind depends on the etiology at the beginning of the treatment of a case,—or at least, before we have finished the case, we should know exactly what is back of the trouble, and whether it will recur unless we carry on a tremendously long drawn out retention.

Dr. Solley as well as Dr. McCoy spoke of the prophylaxis of orthodontic cases. That is very important. I do not care how delicate or how beautiful appliances may be, the question of getting the child to take proper care of the mouth is a large factor. I tell my patients,—and the parents—it makes no difference whether I take off appliances each time and give thorough prophylaxis treatment, this would not prevent the breaking down of tissues unless they do their part.

Dr. Charles C. Mann.—I wish to congratulate the President on his address on the able manner in which he presented the needs of this society and of the specialty as he sees them, and I concur heartily in all suggestions he has offered. With Dr. McCoy I feel the simplification of appliances, especially in the matter of molar bands, is of utmost importance. His suggestion as to the course in orthodontia given to dental students is of large moment.

It would seem to me with reference to the etiology, a proper diagnosis and prognosis of our cases, with a slowing up of the movement,—if I may so speak,—working slowly in some of our cases, is of large benefit.

Replying to Dr. Solley, I have had beneficial results in the use of the black syringe with normal salt solutions. I provide the patients with these syringes and instruct them to use them night and morning about two hours after meals, in conjunction with the regular methods of cleansing the teeth. This has been found in my experience to be very beneficial in preventing decalcification.

Dr. Allen Suggett.—Mr. Chairman: I enjoyed the president's paper very much. He touched on many interesting and vital things. He mentioned certain jealousies and those little conditions which are quite natural to manifest themselves in a comparatively young profession. The profession of orthodontics is rather young, and we perhaps are more interested in certain men than we would be later on. In dental colleges, we had the same thing years ago. Dentists no longer congregate into groups—those from Harvard, Michigan, Pennsylvania, etc. I think that phase is passing. As to the matter of the teaching of orthodontia in dental colleges, I think they are all open to conviction. I think that is a question which will require a little time for us to decide on. So far there have been but few opportunities for getting an education along the line of our specialty. There were the Angle School, Dewey's School, Brady's School and, until the Forsyth organized a course, those were about all we had. The Angle School is no longer available. The only thing we had at the beginning was the instruction given in dental colleges, and that was poor at its best. About all we can hope for along that line is to get the students familiar with malocclusion in all its different forms and teach them how to diagnose it. I think we fail more in the matter of teaching the dental student to diagnose the cases than in any other way. We find embarrassing things among our classmates sometimes. Some of the advice given is unforgivable. Whether it is best to take a few cases and carry them along ourselves, or whether, we shall put some of them in the hands of the students, I find difficult to decide. I think we may do a little of both. If we could have plenty of demonstrators, so that each student could be shown how to put on his bands and adjust his arches properly, that would give him a pretty good idea. Leastways, he would have a pretty good knowledge of what not to do. The advice, which is often given with reference to orthodontia, is about as bad as it can be. Some dentists send cases to the specialist, and in order to save you a little trouble they will remove a crowded lateral incisor or cuspid. You do not always know what has been said to the patient else you might not put the dentist in so badly. But I think, unless we do instruct the students by means of lectures of infirmary work, carrying them along and giving them a good idea of orthodontia, I do not know what kind of advice they are going to get.

We could go into the societies more regularly, write more papers, give more illustrations, with the idea of educating the profession. Perhaps that would be the better way. I think I have neglected my duty and perhaps most of us have. I rather believe

that is the biggest field for our labors, as the dental colleges do not pretend to make orthodontists.

Dr. Mann.—Two things appeal to me with reference to the instruction of dental students. As long as we have three instructors in orthodontics present, it may be timely to mention them. One is the conception of facial normality and arch symmetry according to the type,—and the other is the thorough understanding of normal tooth forms, mesio-distal diameters, etc.

Dr. Solley.—Dr. Cavanagh said at the present time a great many of the orthodontists have their minds focused too fully on mechanical principles. Two things appeal to me strongly. In the schools which teach orthodontics two subjects should be covered more fully, one is the more minute anatomy of the head, and the other is a more thorough study of physiology. I think those two subjects are very important to the man who is starting out today as an orthodontist. We must get down to the etiology of this subject and study it from a more scientific basis than we have done heretofore.

Dr. Morehouse.—I wish to take issue with Dr. Suggett in regard to the question of the colleges teaching more of orthodontics to the dental students. I think there is too much of it taught now. I do not think there is anything so harmful to the laity as the teaching of orthodontia which is being given in dental colleges. This is because they are trying to teach the students how to use in a small way (as they all admit) the appliances we have at hand, and attempting to give them an idea of the diagnosis of malocclusion. I think the general practitioners of dentistry in the United States, who can properly diagnose orthodontic cases are indeed very few in number. If they would just simply learn normal occlusion, and not when the teeth are not normal, they would avoid doing much harm. If they would only refer the cases to the orthodontists without any remarks, oftentimes difficult situations would be avoided as between the family dentists, the patient and the orthodontist.

Speaking quite personally with regard to the dental profession of Spokane, I have had much pleasure in working with the men there, and I am safe in saying I believe that fully fifty per cent of the practitioners appreciate the relationship that should exist between them and the specialist in orthodontia, and accordingly refer the patients without any statements to parents as to what treatment is necessary. The average man who tries to give explanations regarding orthodontic treatment is simply trying to give the impression that he knows a little something, or as much, as the orthodontist does. Some may say "I could do this work, but have not the time and do not wish to be bothered with it." The honest general practitioner says "I do not know anything about it: it is not in my line and I would not give any attention to it at all." That is the attitude of the general practitioners in my city.

So I feel the dental student should be taught to recognize normal occlusion, and to know when the treatment should be started.

Dr. James D. McCoy.—I do not want to be misunderstood as implying I do not believe in the teaching of orthodontia in dental schools, as I do. I made the statement that orthodontia as taught in the average dental school, is more a menace than a benefit. As to the method of teaching, I believe, as I said before, that orthodontia should be considered in just as serious a light as oral surgery, or any other work which requires a skilled operator. In my own work in teaching this specialty, I have followed out in the past twelve years, various methods, and I have been thoroughly and totally discouraged. At the present time I follow this method: I have an assistant and demonstrator who gives one half of his time at the college. He is a conscientious and mechanically capable young man, and during the past year he has placed the appliances on the teeth of those patients accepted for treatment. (I pass upon these cases of course, turning down those cases which I do not believe can be brought to a successful culmination.) So my assistant fits the appliances in the presence of the student, who is to carry the case through. When the appliances have been fitted, the student makes the adjustments in the regular course of treatment, under the direction of the demonstrator. I do not believe the students should even do that, but I have to adjust myself to circumstances as they are. If the methods we are following do not prove successful, personally I am through,—unless I can carry out the work in the way in which I think it should be done.

During the lectures, in which I cover the subject matter of the textbooks, I try to impress the student with the fact that the treatment of a case of orthodontia is a serious matter, because we are dealing with one of the most vital and one of the most

wonderful portions of the human anatomy. No one of us would think of taking a child of our own who needed an appendectomy, or any other serious operation where life and death is concerned, to someone who had but a smattering knowledge of surgery; nor would we place a child in the care of an incompetent school teacher, as we realize the future happiness and usefulness of the child is, in many ways, at stake. If one had a child suffering with malocclusion, I wonder how many of us would be willing (supposing we were not orthodontists, but had some conception of orthodontia) to have our own child undergo orthodontic treatment in the average dental infirmary? Personally I would rather have the case go untreated than have the child subjected to what the majority of patients are subjected to at the unskilled hands of the dental student.

Dr. Carter.—I wish to compliment Dr. Cavanagh on his very excellent paper. He has brought out a number of points worthy of our very serious consideration. I was much impressed with what he said with reference to the mechanics of orthodontics. There seems a tendency in some quarters, to make mechanical engineers, or civil engineers out of us, and while I believe that what has been done along that particular line has been of some value, there seems to be a tendency to commercialize in this particular direction. Dentists who have had no orthodontic training whatsoever, and who are unable to diagnose a case of orthodontia, are asked to send in models, from which maps are made and returned, and the dentists are allowed to carry on the cases. While this work may have been of advantage, I believe we can not treat malocclusion by rule of thumb, because we are dealing with human beings and not with a steam engine or something of that nature.

Regarding the teaching of orthodontics in schools, I believe that is a very serious problem. As outlined by Dr. McCoy, where we have a conscientious instructor at the head of the department accepting only such cases as he believes can be carried to a successful end, there probably can be a great deal of good attained. In this particular respect there is again a tendency to commercialize, and many cases are doubtless accepted, not purely for scientific reasons, but for financial reasons. I do not know how it can be best accomplished, but I believe something should be done to protect the public, because no dental student can fully realize the responsibility he assumes when he undertakes orthodontic interference, unless he be under the direction of a competent instructor. He is liable to do much harm, and may change the dental irregularity from one class of malocclusion into another.

Regarding Dr. Solley's remarks as to the care of the mouth, I have used in my own practice a very simple mouth wash which is very cheap and easy for the patient to get. I recommend they go to the paint store and get a chunk of unslacked lime: place it in a quart bottle, shake it up and allow to stand for 24 or 48 hours until the lime settles to the bottom. Pour out into a bottle or container, and wash the mouth with this lime water. I find that keeps the plaques off the teeth and maintains the mouth in pretty fair condition, and it is also healing in its influence. I got the idea in reading along some prophylactic lines. I believe it is recommended by Dr. Fones, of Bridgeport.

Dr. Sobey.—Just a word with regard to Dr. Suggett's suggestion as to reading more papers before dental societies. I believe most of the men who read these papers will agree that when an orthodontist appears on the program the dentists to not appear at the meeting.

Dr. B. Frank Gray.—I am sure Dr. Cavanagh's address was most interesting—as is evidenced by the very nice discussion which has been accorded it.

As Dr. James McCoy was speaking with reference to the methods of teaching orthodontia to dental students, I recalled that Dr. Frederick S. McKay arrived at the same conclusions a few years ago. Dr. McKay, like Dr. McCoy, if I understand Dr. McCoy correctly, believed the students should not even be permitted to carry on the treatment of patients in the dental school. He felt the ideal way would be for the orthodontist in charge to select the patient, fit the appliances in the presence of a small group of students, and conduct the treatment himself, demonstrating each step of the work thoroughly to them.

Dr. McKay's experience both as a teacher in the Angle School of Orthodontia, and in teaching in a dental school, should make his opinion of value.

Dr. Guy S. Millberry.—Mr. Chairman: I thank you for the courtesy you have extended to me. Administrative duties at the school interfered with my being present here earlier in the day, and I regret very much that I did not hear Dr. Cavanagh's address. Not

knowing just what he presented I shall have to speak to the discussion rather than to the address.

The question of dental education has been of paramount interest to me for many years. I feel that the orthodontists have a very well defined problem and a duty in presenting to the dental educational institution their views with regard to the teaching of orthodontics. I disagree with some of the speakers who claim that it should not be taught in the dental schools. The progenitors of your speciality have labored hard to the end of carrying orthodontics into medical science as a specialty, although we have generally believed it to be a specialty in the profession of dentistry. To whom will you look for training in this specialty and the education that is necessary to fit one for its practice, if the dental schools are not the proper place? If more attention must be given to this subject then it should be the duty of the dental schools to teach it adequately. If no training is given in the dental schools and men go out into the practice of dentistry without some special training will they be able to secure enough training in the basic principles in your field of work while attending the short courses now being given privately to make them proficient? We are going to have more time during the four-year course to give to this subject, and in my opinion it should be developed.

The time is not far distant when the man who chooses dentistry as a profession, will enter a college or university for two years of academic work where he will receive fundamental instruction in chemistry, physics and biology, plus some cultural studies. During the next two years in the university he will then study the basic subjects in medical science, namely anatomy, physiology and pathology. Anatomy is frequently taught very thoroughly and often very carelessly. In some schools it is given in concentrated form during one semester only. In other schools it is spread out over a period of two years. A knowledge of anatomy is very essential to the orthodontist. Physiology is probably one of the most neglected subjects in dental educational institutions today, and it, likewise, is an all-important subject to the orthodontist. After having completed his basic preparation in medical science the student will then enter upon a study of his specialty. In medicine it may be as a rhinologist or internist or a surgeon. In dentistry it may be in orthodontics, in prosthesis, in surgery, and ultimately all of them will be included in the general science of medicine.

Your work occupies a sort of interrelationship between rhinology and dentistry, and as I study the problems involved, it seems to me that more is expected of those men having control of the mouth, nose and throat than of any other group in medical science because their work is preventive in character, and they can alleviate further suffering more than any of the groups mentioned.

You should evolve some plan whereby orthodontics can be taught in a more general way to the regular dental practitioner. He should be more familiar with your work, and if the members of the dental societies will not listen to a paper on this subject, why not have a section in the National Dental Association devoted to this special field in medicine with its own particular place in the annual program. If you limit your literature to a journal on orthodontics exclusively, very few of the regular practitioners of dentistry will subscribe for it, whereas if you had a section in the journal of the National Dental Association devoted exclusively to orthodontics a very large percentage of the men in this country would be likely to read it, and you can thus disseminate your knowledge.

As an association, the Pacific Coast Society of Orthodontists can have a wonderful influence in helping to mold orthodontic practice in the West, and especially so if you lend your assistance to the institutions who desire to do what is best and right in this regard. I believe that every student entering the dental school should be taught as much as is possible in the subject of orthodontics. There are very few specialists in communities of less than twenty-five thousand people. Men who are practicing in communities of six to ten thousand people should have a fairly good knowledge of the subject so that they may be in a position to either direct the patient to the specialist in the city or be able to render some service themselves if the case is not too difficult. They should at least understand the requirements of a given case and of the complications involved in the handling of it.

I trust that your Society will feel free to call upon the University of California for any assistance that it may be in a position to offer you, whether it be in facilities for disseminating knowledge or in investigations of any sort, and I also trust that we may feel free to call upon your society for such help as you can give us in developing this problem. I also hope that I have not digressed too widely from the subject presented

in your President's paper, and again thank you for the privilege of being in attendance at your meetings.

Dr. Mann.—As to the matter of bringing orthodontic matters before dental societies, in the County Society in Seattle, we have one night devoted to orthodontia, and the meeting is well advertised among the men. If I may be permitted to say so, that meeting is well attended. It has proved a satisfactory arrangement.

Dr. Cavanagh.—I wish to thank the members present for their kindly consideration of my address—the first of its kind I have attempted. I feel I am only now prepared to write an address for this Society, after hearing the discussion. To enter fully into the points brought up and discussed here would require a longer period of time than the writing of the address in the first place. I feel flattered by the very full discussion you have given it, and would like to touch upon many subjects again but can only take time for a very few.

It is a peculiar circumstance that in dental colleges, where so much time is spent in the prosthetic laboratory upon the arrangement of artificial teeth and in the making of artificial dentures, that from that work the student gets no conception of the normal occlusion of the teeth! They can arrange a set of teeth so that the cusp relations will be right, but in the mouth where malocclusion is present, they have no idea of what is wrong. It should occur to the student from his instruction and training in prosthetic dentistry, how to recognize malocclusion, but they do not connect the two ideas at all.

Now as to the teaching of orthodontia, I find it a joke—if you can conceive of a serious joke—to try to handle perhaps forty or fifty cases in the dental infirmary. One man is expected to lecture an hour on a stated day, giving perhaps thirty-two lectures in all. I am given one-half day in which to demonstrate in the infirmary. It is impossible to handle over five or six cases correctly in that length of time. I think no attempt should be made to compel a dental student to take any practical work in the infirmary, and if the choice is given and any one in the class is going to be favored with special instruction, it should be given to those men who have determined to locate in the small towns. The best men in the large cities do not attempt orthodontia. The man who does the best work in his regular dental practice says: "I know too much to attempt a case in orthodontia." I state to the class that I am not going to make orthodontists out of them. That I will try and teach them the etiology and the diagnosis so they will recognize malocclusion, and then they are advised to let it alone. I endeavor to teach the part they play in bringing about malocclusion, so they may avoid it. That is all we can teach today, under the present status of things.

As to the prophylaxis of malocclusion, the dentist can contribute immensely in some of the serious cases we have to handle. The effort to teach the application and use of the more delicate orthodontic appliances to the students, should not be undertaken. It does not belong in the dental course. I think the student may be made familiar with the use of appliances which are intended to prevent malocclusions in their incipiency. For instance an anterior tooth may be diverted in twenty-four hours at times, from an approaching condition of malocclusion to one of normal occlusion.

In touching on the remarks of Dr. Solley and some others, I wish to say as to the recession of the gums, this is at times due to too rapid tooth movement rather than to any uncleanliness on the part of the patient. We get an absorption in such cases, which may never be replaced, through an attempt to force cases too rapidly. Especially does that apply to adult cases where you attempt to hasten the movement. This condition is especially noticeable in the lower anterior region.

Our relation to medicine, as Dr. Millberry has intimated, is very close. We should have the very hearty support of the nose and throat specialists, and especially should we have the cooperation of those men who realize as I think Dr. Cryer has said, that orthodontia is more difficult than anything else, unless it may be oral surgery.

In the matter of orthodontists appearing before dental societies, some of the same things are required as in the teaching of dental students. We must have models, appliances and the lantern. You can secure attention in that way. I will never read another paper for a dental society unless it is an illustrated paper. The dentists do not come and do not know whether the paper may be good or not. They are down where the dental supply houses have their exhibits and you have nothing of that kind to offer (nickel-plated instruments, etc.)

Here on the Pacific Coast, where we so frequently have prominent dentists from the eastern part of the country as lecturers and clinicians, we should have an orthodontist who would also attend our state conventions. He could present these subjects,

with the proper aid of slides and models, showing the very conditions we are supposed to teach in dental colleges.

The neglect of the temporary teeth by the dental profession is deplorable. Not one per cent of the dental profession take care of the deciduous teeth as they should. They postopone the filling of this cavity for a while: it is so very small now. The patient comes back after an attack of pulpitis. Then a pulp treatment is required: there may be an abscess and you have to remove the tooth and there is an interruption of the development of the dental arch. Malocclusion results, especial in the temporary molar region. Those are the things we have to teach dental students, and we must bring them more emphatically before the dental societies as well. And I think we should also teach these things in the societies of the nose and throat specialists.

We know little of inherited conditions. What can we do with an inherited condition? I believe they play a more important part than the textbooks give credit for At one time it was given a more prominent place than today, and yet I am convinced that heredity plays a most important role in some of our most stubborn cases. We can attempt to correct them. but we have no power over them. It is the local and acquired conditions which we can deal with successfully. As to the conditions of malocclusion acquired through bad dentistry, we should be able to do much in the way of enlightenment, presenting the matter to the profession through the aid of models, illustrated lectures, etc., as suggested. I am not in favor of giving the dentists a smattering of the knowledge we possess by bringing before them appliances to show them how to regulate teeth. Until the fundamental principles of the prevention of malocclusion are understood it will serve no useful purpose.

Death of Dr. John W. Parsons

ON February 28, after an illness of one week following an operation for appendicitis, Dr. John W. Parsons passed away. "Gone, but not forgotten" can truthfully be said of him, for there was no one who had more friends; in the words of old, "He was loved by his fellow-men."

Dr. Parsons was one of the organizers and first presidents of the Huntington Dental Society and was always active in the upbuilding of the profession in his state. He had been and was at the time of his death secretary of the West Virginia Dental Society. He was also president of the Alumni Society of the Dewey School of Orthodontia from which institution he graduated two years ago. Upon taking up the practice of orthodontia, his efforts were characterized by the same painstaking methods as were observed in the practice of dentistry.

He will be missed by all of his friends in the dental profession and by none more than by those who knew him in the field of orthodontia. To his classmates at the Dewey School of Orthodontia his death was a great sorrow. To the editor his friendship was one most highly appreciated and as fitting tribute to his character we know nothing better to say than—he was loyal to his friends.

—M. D.

DENTISTRY FOR ALL THE PEOPLE*

By Allen H. Suggett, San Francisco, Calif.

A COMPREHENSIVE survey of all the benefits that dentistry in all its branches is conferring on those who can afford to pay for it, would naturally suggest the question, What effort is being made to make these great benefits possible to all the people?

If good teeth, healthy mouths, and perfect occlusion, are so necessary for the health, comfort and happiness of all the people, then to bring this about, should be the ultimate goal of every dentist. Some of the other countries are making greater strides than we are. In 1910 the school children of thirty-three cities in Germany were furnished dental services by the government. England is proposing to socialize medical and dental services. Russia is about to do it, and no doubt will, as soon as they have time to put it in force. They already have over six thousand cooperative societies.

Not many years ago, schools were only for the rich, and colleges only for the literary. Everyone who could not pass an examination in the classics was thrown on the scrap heap, as far as a chance of getting an education was concerned.

This condition has gradually been changed to meet the wants and demands of society, until instead of just one literary course, there is at least one university, that gives as many as 500 different courses.

The trend of the times, is to have conditions so favorable, that everyone coming into the world, will have a chance to do the thing for which he has the most talent. Schools, industries and the professions are being socialized, as never before, for the most conservative have to admit that the common good must first be served during these times.

If it is necessary to take care of our health, so we can fight better, why is it not equally as necessary in the great fight for subsistence?

If we take the bodies of the fathers, sons and brothers, and put them in the trenches, from which many never will return, if we can take the lives of our people, for the common good, why not take the wealth for the common good, not only for war, but for peace, health and happiness.

We have free schools and free books, but what good are these, if we do not conserve the health. It is not even good business to neglect the physical and mental well being of people, and then have to support them in idleness in hospitals and jails.

I examined the mouths of five hundred children in five of the public schools of this city, and found about 85 per cent in need of dentistry. Some had as many as twenty-one cavities, many had abscesses. Frequently the abscesses had broken on the face producing permanent scars. Many of them had worn poultices of fat meat, etc. It was pitiful to see some of them suffer from toothache and lose valuable time from school. There was the usual percentage of

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malocclusion with all the accompanying symptoms, narrow arches, receding chins, adenoids and tonsils, etc.

The expense of dental services is beyond most of them, for they are not properly clothed and fed. Here is the source of the great horde of unfit, that rise up against society, and they beget more unfit, and more.

Medicine is working toward prevention, dentistry is dreaming of a time when we will prevent, rather than cure. We will also be one of the important factors in preventing the unfit. Now is the time when everybody is thinking of the common good to push these democratic measures. They will be opposed as impractical, just as freeing of the slaves was opposed, and free speech and free press, free public schools, and the pure food law, and the thousand other rights the people have won.

If it is democracy to take care of the mouths of the soldiers and sailors, why not for the people? We are making a feeble effort to do it by charity. If they have no right to this service, why attempt it by charity? If they should have it, it should be done by tax support. We give charity when we should give justice. Charity only puts off justice. If all the rich and influential people who are in the Associated Charities, the Catholic Societies, the Hebrew, the Methodist, the Episcopalian, and the hundred and one societies who are working so hard to relieve the distress of the poor, should unite all their resources and demand of the legislature and city councils appropriations to do this service under the State, County and City in a democratic way it could not be refused.

Now is the time to push all these measures forward for the people are thinking of service as they never thought before. If soldiers can not fight effectively without good teeth and healthy mouths, how could they mine coal, can fruit, plant crops, and make delicate instruments.

There are plenty of dentists and physicians who would gladly work for the state, for much less than they might make in private practice. To prove this, we need only mention army officers, judges, college professors, etc. It is important to remember too that as these democratic measures are introduced, when more and more people are interested in service, we will begin to see that the pay will be more nearly equalized.

If the greatest surgeon, the greatest physician, chemist or engineer, men who have spent years and years preparing to be experts, if these men are only paid a few thousand a year, why does society pay other untrained men millions. Even the president of the United States is only paid $75,000. The policy of big business is to pay the workers small wages and the higher ups enormous salaries. The government's policy is to pay the workers more and the higher ups less.

The great trouble is, that each one is more interested in getting unearned money than in solving the social problem. The great business interests are not trying to solve the problem. They are so well pleased now that their powerful influence is against any change. They only think of a change that might put them down and another fellow up in their position. It is the position that should be abolished.

When these big leaks have been stopped, the huge unearned fortunes abol-

ished, there will be plenty of means so every child can be educated to do the thing he or she can do best. They can have their teeth preserved, their health guarded, and everything else that is necessary to make a good and useful citizen.

As we remove graft and special privilege, we will automatically remove that powerful group of men who oppose all democratic measures, and it will never again require eighteen years to enact a pure food bill.

If dentists were employed by the county just as the teachers, the judge, and the sheriff, and county physicians, they could do preventive work instead of almost entirely reparative. Dr. Fones reports that as a result of four years' prophylactic work, he has been able to reduce caries from 85 per cent to 15 per cent.

There would be many details of the *modus operandi* to work out as they came up. As to pay, it would be less than many are able to make in private practice. For those who would prefer state work, there would in time be worked out pensions, etc., as in the army, so that the dentist would not have to save up for a day that might never come. He could freely and safely use his income for the education of his children, pleasure, etc. If his children were properly educated they would be able to earn their way in the world. If every one had to serve and earn his way, useful labor would cease to be a reproach. There would be no wealthy unemployed, there would be no poor unemployed, and all could serve in their own way.

DISCUSSION

Dr. Cavanagh.—You have heard Dr. Suggett's paper and those who read the current literature of the day know that what he has written is in line with the tendency of the times the world over. The world is becoming more socialistic. Things transpiring daily bear this out. The underdog is having a better chance, and the man receiving too much must be content with a little less. In dentistry we have just touched the wealthy you might say, and left the masses without our services. Dr. Sobey will open the discussion on this paper.

Dr. Sobey.—Dr. Suggett has given us a paper on a very broad subject, dealt with in a very broad-minded way, and showing that he has given this matter his particular attention. Records show that his interest in that matter dates back at least to the year 1910. I feel it well in discussing such a paper to outline to you some of the work that is being carried on in our own locality.

At the present time in the San Francisco schools two dentists, with assistants, are employed each for one-half day, and are paid out of a fund appropriated by the Board of Supervisors for that purpose. At a recent meeting of the San Francisco District Dental Society a resolution was adopted "that steps be taken to have provision made for the employment of twelve dental hygienists," and furthermore, that a room in every new school building erected in this city be equipped with "adequate facilities for school health activities." In doing this we are following the example set by Dr. Fones in the schools of Bridgeport, Conn., of which Dr. Suggett has made mention.

The University of California makes provision for the health of its students by providing medical and dental services for a very nominal charge to make the infirmary self-supporting. At present two dentists working a full day each can not handle the work which presents itself.

In our two State prisons all convicts upon entering are given first a physical and second a dental examination. 91% are found to require future dental services which are charted at this time. Extractions, treatments, cement and amalgam operations, dentures and clasps are free, gold and porcelain work being done if the patients can pay the costs of materials.

Probably the biggest thing in social advancement for the people of the state is a proposed amendment to the constitution which will empower the legislature to pass

any kind of social insurance bill. The Los Angeles County Medical Society has drawn up a tentative act which has been published, and is under discussion by other societies. Its subject is "To enable the worker to meet the expenses of his illness and to compensate him to some extent for the loss of wages upon which he and his family depend for their sustenance."

If dentistry follows in the footsteps of medicine the time will come soon when all the people of the state will be properly cared for.

Dr. Dunn.—I think we are very much interested as a society in what we can do in our line of work for the children of the poor. It seems almost impossible to solve this question, because of the vast amount of detail and responsibility attached to malocclusion of the teeth. It would seem if the poor are to receive orthodontic services it must be through such an institution as the Forsyth or Eastman Dental Infirmary—that is through an endowed institution. All of us I think take one or two of these cases and carry them through. As a rule these patients are with us for several years. We do not have the full and necessary cooperation in the treatment. We undertake them because of some vitally important consideration which makes it seem so urgent. I do not believe it is possible for us to undertake to do much of this work. Through proper teaching we should be able to show how, through a little attention to the deciduous teeth, many of these conditions of malocclusion can be prevented. We are all familiar with the vast amount of work being done along preventive lines among children. If we could educate those having that work in charge, in preventive methods, a very great deal of malocclusion of the teeth might be stopped in its incipiency. I see no other way in which we can possibly handle the subject adequately.

Dr. Suggett.—I think Dr. Dunn missed the trend of the paper a bit. It is not a question of what we do. I am absolutely against charity. We may, however, need to do some charity work in our practices. I help some of these cases like others, but I oppose the idea. This work is not to be attempted by Dr. Dunn, by myself, or other individuals. Such a method is not democratic. We must not follow the methods of the Associated Charities who solicit subscriptions of $6 or $7, or possibly $100, or $1,000. This service needs to be performed by some state or national institution which is tax supported, the funds coming the same as for schools, etc. Charity does not solve the problem.

Dr. James D. McCoy.—I think our essayist has considered this very important subject in a broad and comprehensive way. He has outlined a very Utopian state of affairs which I am sure we hope may be realized some day. If such things are to be realized they must have a start, and the sooner we can commence educating the people to think along these lines and realize the benefits of humanity which would come from such a plan the better it will be for the people at large. I think so far as dentistry is concerned the masses may be educated in no better way than through the methods in vogue in the San Francisco and Los Angeles Schools. We have in these schools, working under the direction of the school board, dentists who care for the mouths of children free of charge. This work is done only for such children as could not otherwise have the work done. This movement started in Los Angeles a number of years ago. The Los Angeles County Dental Society subscribed enough money through its individual members to employ a dentist who was compensated at the rate of $1800 per year. The Dental Society provided the equipment. Through a great deal of argument and much pressure the School Board finally consented to allow us to place this operator in one of the schools. We called this our special "Parent-Teacher's Clinic," I think. The clinic rooms were on the grounds of one of the schools located in a poor section of the city. They allowed us to put our operator at work there, taking care of these children. It really required the pulling of wires in order to confer this benefit, but we were eventually successfully, I have stated. In one year's time the benefits to the children were so great (you can realize one operator could not do a great deal) that the following year the school board assumed the responsibility of this clinic. Instead of employing one dentist they secured two, and have maintained them ever since. Shortly thereafter they also established in this clinic (now known as the "Parent-Teachers' Clinic") a clinic for the eyes, nose and throat. Therefore that work is now being carried on, not as a charity, but as a democratic measure for the care of these school children.

The operators now employed in the Los Angeles Clinic can not take care of more than just the emergency work. I think through educating the school teachers, school boards, etc., to the great benefits of this work the time will eventually come when every

school will have its dental as well as other clinics established, and it will all revert to the advantage of the children. Of course dentistry as it is practiced for the most part resolves itself into the question of reclaiming dental wrecks. When we are dealing with children we can make it a matter of prevention too. If these things prove to be successful with the children of course it will encourage politicians,—or statesmen, as sometimes we have statesmen as well as politicians—to institute these measures along other lines.

Dr. Guy S. Millberry.—Social dentistry has evolved out of the problem of school dental hygiene in which I have been very much interested for the past ten years. The reader has mentioned some phases of the work in other countries, speaking particularly of Germany. We have not been able to get very specific information during the past three years from foreign countries, but we do know that our own country has made very rapid progress in an effort to socialize dentistry here, especially with regard to the children in the public schools. While it is generally believed that Germany and England took the first steps in regard to school dental hygiene, the progenitors of socializing dentistry, you may be interested to know that such is not the case for in Rochester, New York, in 1889, two years before the work was commenced in Strassburg, the dentists of the former city began work which ultimately resulted in the esablishment of the Rochester Dental Dispensary. This institution is designed to study the problems of preventive dentistry, to find out whether the work in prophylaxis early in life will prevent all those diseases which we maintain can be prevented by such methods, and so we have a Research Institution there rather than a public clinic.

The work in the Forsyth Infirmary is primarily charitable in character, and it was formulated on such a basis by the Forsyth brothers, one of whom experienced, during his travels, the discomfort of having had to listen to the wail of a child through the night who suffered from a toothache. Isn't is remarkable that such a wonderful institution has come out of the experiences of a child suffering from a dental disorder! A statement has recently come, indirectly from the Forsyth Infirmary, in which it is claimed that they find that 96 per cent of the children below the age of 6 years have some form of irregularity of the teeth, and that as a result of examination of a number of children below 4 years of age there is little evidence of the need of orthodontic work. Whether measurements have been taken to determine the width of the arch as a diagnostic aid in confirming this or not, I can not say, but if it be true that the children before the age of 6 years do not require orthodontic treatment in a large percentage of cases, and that they do require it after the age of 6 years, will it not be possible to devise some means of preventing malocclusion early in life? Perhaps the suggestion of your President that hereditary influences are important factors would have a bearing on the study of this problem from the standpoint of prevention.

If Fone's unverified reports that he has been able to reverse the problem of caries so that where we formerly found 85 per cent of the children suffering with carious teeth and now find, under the school hygiene and prophylaxis as practiced in Bridgeport, that but 15 per cent have carious teeth, would it not be a very wonderful thing for us to endeavor to so socialize dentistry as to enable the larger portion of our people to go through life with a reasonably sound and a fairly accurately occluding set of teeth?

It may interest you to know that the preventive work in dentistry both in England and Germany was largely the result of the Boer War. Men in the military service in both countries suffered greatly from dental disorders, and a large number of recruits were rejected because of bad teeth. These recruits of course came from the industrial classes, and the government realizing that both the military and industrial classes come from the children in the public schools, immediately set to work on the problem of preventive dentistry in the public schools, in order that the industrial workers and the military forces would not be subjected to the ravages of the dental diseases when their services were needed most by the government.

In regard to the conditions in our city schools in San Francisco, Doctor Suggett has touched upon this problem. I recently had a conference with Doctor D'Ancona, member of the Board of Education of this city, and the suggestion was made that we establish in every new school building under the new bond issue, a dental office in connection with the nurses quarters and the medical officers quarters. He felt that the matter could be very easily arranged for, so that we will probably have a small suite of rooms in every new building devoted to the health of the children, for we have to carry out not only the idea of educating the children mentally but physically as well.

In Los Angeles they have three dentists employed by the Board of Education, and

there are 85,000 children in the public schools with only three women to take care of them rendering dental service. The problem is staggering.

As to taxation, whenever we discuss this phase of the work with people who have been charitably inclined, they hold up their hands in holy horror at the idea of being taxed for this particular work. Perhaps after the war is over some of the taxes, which at the present time are unusual in amount and character, may be devoted to some other phase of endeavor with profit to the people of this country.

I think that this Society, as well as others, can influence the people through educational methods. How many of you are cognizant of the work of American School Hygiene Association, which at its annual meetings discusses every phase of the child's welfare including social and sexual problems, sanitation and ventilation, hygiene and especially the care of the mouth, teeth, eyes, nose and throat. I think it would be a good thing for each orthodontist to take out membership in that Association and inject into it their ideas along the lines of preventive dentistry from their own particular viewpoint.

Dr. Solley.—I do not know if I understood Dr. Millberry correctly or not, but in his mention of the report of the Forsyth Dental Infirmary I believe he said the amount of irregularity among children under four years of age is almost nil.

Dr. Millberry.—Very nearly.

Dr. Solley.—I can not agree with that. I think the most of us have seen much irregularity in children under four years of age.

Dr. Dunn.—That is because the examiners were not sufficiently familiar with the deciduous teeth to be able to determine when a condition of malocclusion was developing. There is no question in my mind, after some years of experience, that wherever there is an irregularity developing at eight years of age, it must have been present in its incipiency at four.

Dr. Suggett.—Mr. President and members: This is a subject about which we shall hear more in the next few years. If we stop to think, we must appreciate that we have barely scratched the surface, and that it will be impossible to serve the people in any adequate manner, unless we socialize it in some way. Kicking against taxes is a sort of habit with a great many people. I have a friend who has made a large sum of money. He came here and started at $25 a month and now is worth several millions. He is long on charity and likes to head the list, but whenever his taxes are raised a little, he nearly has a fit, and seems to believe the government is his enemy. Anything that is along the line of tax support he is absolutely down on. But I believe we get more for our taxes, as poorly as the money is sometimes expended, than for any other expenditure. As graft is done away with, we will eliminate the influence of the people who fight against our democratic measures. With the elimination of graft these people will become interested in good schools, good roads, good government,—like anyone else. With this improvement in his outlook, it is not difficult to see that in due course of time he might come to wish for good conditions for everybody, as well as for himself.

To develop the nation, means that we must develop all the people. That would mean that all the people should have an opportunity for education and health and an equal chance in life.

Dr. Mann.—If you will pardon another reference to Dr. Sugget's paper I will say it is to be devoutly hoped this socialistic millennium which he proposes shall come about. When it does things will be so organized that every individual will do only the amount of work necessary for his maintenance, and there will be no necessity for the democratic distribution of wealth.

Dr. Cavanagh.—Verily we have Trotskys in our midst. We can appreciate the chronic kicker on taxes. He is like the chronic kicker on the payment of our fees. It makes no difference whether a person receives from you an estimate of $500, or $250, or whatever it may be, he had it in his mind when he entered your office to complain at the fee and he will do so at any rate. The idea of graft in the government I think causes some of the reluctance people have felt at paying their taxes, and I think some of them who pay our fees feel that there is a little graft in it somewhere.

HISTORY OF ORTHODONTIA

(*Continued from page* 116.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

W. E. MAGILL, in order to rotate teeth, constructed a plain band of platinum, cementing it to the teeth. Although this type of band had been used centuries ago by the Phœnicians, and was later reintroduced in orthodontia by various men, C. A. Harris and others, prior to Magill, it is now sometimes known, erroneously, as the Magill band. In a letter to Dr. Farrar, Magill said in speaking of the use of this band and its priority, "I did not make use of it until 1871, and do not claim it now."

The real value of the plain band, however, dates from its attachment to the tooth by means of oxyphosphate of zinc cement and here again we have no definite way of determining the question of priority of use as both Drs. Shepard and Magill failed to record at the time their method of attaching the band to the tooth.

Just when oxyphosphate or oxychloride of zinc cement was introduced to the dental profession in America we do not know, however, we find that it was used prior to 1870 in England, but as far as records are available we fail to find the use of cement for orthodontic purposes mentioned prior to Magill or Shepard's time. Dr. Farrar, in his *Irregularities of the Teeth,* etc., page

Fig. 1.—Magill band.

1229, says in regard to both the band and use of cement, "Magill wrote to me (Oct. 15, 1888) as follows: 'Referring to record of work done, I used the cemented band in 1871. Have never made any claim to priority of use. I make each band of platinum; form it on the tooth to be rotated; remove it to solder, and afterwards adjust and solder on the bar. My use of the bar was coincident with the use of the band because the object of the mechanism was to rotate a cuspid on its axis.'

"*L. D. Shepard* claimed he had used cement for this purpose as early as 1867 but the kind of cement he used I have been unable to learn." (Farrar.)

Magill before the Pennsylvania State Dental Society, 1888, published in the *Dental Cosmos,* page 678, spoke on *Dental Irregularities and Their Corrections,* as follows:

"When irregular teeth are presented for examination and advice, the first question to decide is whether you had not better let them alone. This is the question of questions, upon the wise decision of which may depend your reputation, your comfort for a considerable period, and not only your comfort, but various important results to your patient. No hasty conclusion should be adopted. Nature can do wonders, and may be competent, if given time, to

right all that seems wrong. The desire to experiment on a new case, or to try a new appliance, is always strong enough to be difficult to resist. However these influences move you, make up your mind once for all at the outset, that no fee, present or prospective, shall induce you to undertake a case against the dictates of your deliberate judgment.

"I am in favor of intermittent force for moving teeth, and for the following reasons:

"1. It involves less pain to the patient, or, what is equivalent, gives periods of rest and relief from soreness.

"2. It is the safe plan. It is but seldom we can move a tooth without some irritation of the investing membrane. If we limit movement we may limit irritation, and therefore have less anxiety about a case when the patient is beyond our reach.

"3. It gives time for natural process of repair. It is of no value to move a tooth so rapidly that an open fissure shall develop in its wake. Therefore, for power preference would be given to the screw or wedge, or combination of screw and wedge, or screw and lever, for ease of control and convenience.

"While ingenious appliances are helpful in practice, the same results are sometimes attained by means more direct and less complicated; and in this department of practice the pressing demand is not so much for more machinery as for judgment, wisdom, and deliberation."

C. Wedl, in 1887, *Vierteljahrschrift für Zahnheilkunde*, classified the forms of irregularities of the teeth into the following nine groups: "1. Where the anterior teeth are straight or flat. 2. Where the upper and lower anterior teeth projected. 3. Where the maxillæ projected. 4. Projection of the mandible. 5. The two jaws in irregular position. 6. Anterior teeth were inclined backwards. 7. Open bite. 8. Hypertrophy of the alveolar arch and 9. Extreme overbite. The basis of this classification depended upon the position of the teeth, their size and number.

"Irregularity of the permanent teeth depended upon how far the deciduous teeth happened to be separated, although he seldom found the deciduous set of teeth irregular in position or form."

W. K. Brenizer, in the *Dental Times* on *Six-Year-Old Molars*, October, 1868, says:

"That the six-year molar, in itself, is of no more importance in the mouth at twenty-one years of age, than any other one tooth that may be as good in structure, appears to me to be a self-evident fact, and that whatever might be said of its importance to the well-being of man, might be said with equal justice of any other tooth, is equally true. Take, if you please, a perfect denture of thirty-two teeth in a mouth, with all the teeth in their places, regular and comfortable, and no signs of decay, and who that professes to be a dentist would extract the six-year molars from such a denture? and who that is less than a knave would dare to extract any one of the other teeth from that mouth? But since such dentures are the exception and not the rule to be met with it has become necessary for the well-being of his fellow-men for the dentist to be admitted into the family circle, that he may begin his observations almost at the side of the cradle.

"From the advocates of all the teeth being present, and who absolutely never extract a tooth, but in gimberjaw spread the jaw, and throw the teeth out over their already prominent neighbors, we have but two reasons given for the practice of which, if any man should fail to follow, he should be thrust out of the profession. They are, first, development of the jaw and face; and, second, the tipping forward of the tooth next to the one extracted. These two are all the reasons we have seen urged by those who advocate the absolute necessity of keeping all the teeth in the mouth. Of the evils resulting from all the teeth being present, or too many teeth being present for the jaws to accommodate comfortably, I am going to name:

"1. The irregularity of the six lower front teeth, representing something like the teeth of a saw, one tooth pointing inward, another outward, going on alternately through the six teeth, and sometimes including the bicuspids, thus making it impossible for the patient, however much disposed, to keep them clean, and eventually, through the instrumentality of the deposit of tartar, before the age of forty, and sometimes thirty years,—if the teeth are strong enough to resist decay so long—they drop out of the mouth perfectly sound teeth, and that the same result from the same cause, sometimes happens to the upper front teeth.

"2. The canine teeth, crowded outside of the arch and pressing downwards so hard as to decay the lateral incisor and first bicuspid in the effort to gain their proper place.

"3. The bicuspids, inside of the arch and completely crowded out of their place.

"4. The wisdom teeth, or dentes sapientiæ, in some one of their many abnormal positions, either facing outward toward the cheek, inward toward the tongue, or forward, leaning hard against the second molar, or imperfectly developed, with three-fourths of the face of the tooth remaining covered with gum, which is always more or less sore, and occasionally giving rise to very serious consequences, or, it may be, never developed at all for want of room to appear in. Allow me to stop just here to say that I consider these various abnormal positions that the wisdom tooth is forced to assume, in the effort to gain its proper place in the jaw, is one of the strongest points in evidence of the deterioration of the jaw in size, and that nine out of every ten of the mouths to be met with in our country in the present day, would be bettered in every way by having one tooth less on the side of each jaw.

"The injury of all the teeth by decay and eventual loss, sometimes of the most important teeth in the mouth, and the attendant expense of doctoring and plugging all the cavities caused by the pressure of one tooth upon another."

Oakley Cole, in 1868, began to write occasionally on deformities of the mouth. In that year in the *British Journal of Dental Science*, July number, we find an article of his under the title of *The Mechanical Treatment of Oral Deformities*.

In the *Monthly Review of Dental Surgery*, 1873, under *The Transmission of Hereditary Peculiarities*, Cole discusses the possibilities of transmitting dental peculiarities from one generation to another, but arrives at no definite conclusion, merely reporting six cases.

In the same journal, page 301, under *A Simple Method of Regulating Teeth*,

the same author describes the following plan to remedy the irregularity of the teeth:

"After measuring the distance across, from the most prominent part of the labial surface of the canine to the centre of the labial surface of the central incisor, cut off a stick of compressed hickory (in the round form) of the measurement obtained, split the stick in two, or cut it down till you have a half-round stem of wood, the one surface being quite flat; trim up the ends so that they do not present any sharp edges to the lip, this can be applied to the mouth or model, the two ends resting by the flat surface upon the canine and central teeth, care must be taken that free space exists between the surface of the wood and the lateral that is to be drawn forward, if the flattened surface is in contact, room may be given by filling a concavity in the wood immediately over the tooth; the wood being fitted in a satisfactory manner, a piece of gilling thread (American hemp, small size) is passed double between the central and lateral, and then passing behind the lateral tooth close to the neck, the double thread is brought out again between the lateral and canine; we have then on the labial side, the loop projecting next the central, and the two ends of the double thread projecting next the canine, while on the lingual surface we have the double thread closely embracing the neck of the lateral. If we now tie the two ends of the thread (next the canine) together so that they embrace the end of the hickory, the other end being embraced by the loop, we exert considerable pressure upon the lateral tooth; (1) by merely trying; (2) by the contraction of the thread as it becomes moistened by the saliva; and (3) by the expansion of the compressed hickory, tightening the thread still further. This appliance needs renewal twice a week, but intelligent patients can do it for themselves or their friends can do it for them.

"It is obvious that the same principle can be applied to the treatment of a great variety of irregularities, modified of course, according to the requirements of each case. At the same time I remark that its advantages over treatment by plate are considerable; (1) it is not liable to displacement; (2) the teeth can be kept clean without removing the thread and wood; (3) the progress made is easily seen and recognized both by patient and operator; (4) the pressure is continuous and not under the control of the patient; (5) it is not unsightly in appearance, and lastly; (6) it is inexpensive, so that in hospital practice many more patients can be treated than by the old method."

Cole expressed the opinion, which was held by others at that time, that the best types of English jaws made an equilateral triangle. He applied Greek names to the different classes into which he divided various types of dental arches, basing his classification on the forms of the arch. Intermaxillary prognathism he attributed to a force originating in the sphenoid bone and acting on the intermaxillary bones. Under *Deformities of the Upper Jaw: an Attempted Classification of Them,* page 103, *Transactions of the Odontological Society,* 1879-80, he classified the deformities of the maxilla into seven groups. 1. Dolichoid jaw (long). 2. Brachoid jaw (short) contracted maxillæ. 3. Macroid jaw (large and massive). 4. Microid (small). 5. Intermaxillary prognathism. 6. Intermaxillary upognathism. 7. Lamboid jaw.

"After a series of measurements and experiments that I need not now de-

scribe, I arrived at the conclusion that the triangle was the best geometrical figure for the object that I had in view, as it gave in the simplest and most diagrammatic form two at least of the measurements that were required, namely, the length and breadth of the dental arch.

"Desiring to form a triangle that should be applicable to the largest number of cases, whether edentulous or not, and capable of use with approximate accuracy to all races alike, I decide to form the base of the triangle by an imaginary line drawn from the centre of the distal surface of the second molar on each side, as near to the level of the alveolus as the third molar (if present) would admit of. By choosing the second in preference to the third molar, I disposed of the liability to error arising from abnormalities of the wisdom tooth, and at the same time was enabled to take my measurement at any period after the thirteenth year of the patient's existence.

"One other object was gained by the choice of this position, and that was that the absence of the molars on one side of the mouth did not of necessity render measurement impossible, as the centre of the distal surface corresponds very nearly with the centre of the alveolar ridge which in this region is generally well marked.

"The base being thus obtained, the remainder of the triangle was produced by lines drawn from the point of contact of the mesial surfaces of the two central incisor teeth to the extremities of the base line already referred to. This incisive point, as I shall hereafter call it, still keeps the angles of the triangle upon the central line of the alveolar ridge, so that in this respect again we measure from a point of least variation.

"We have thus formed a triangle, giving at the molars the breadth of the jaw, and by a line drawn from the apex of the triangle to the centre of the base line the length of the jaw, exclusive, of course, of the space occupied by the third molars.

"This interbicuspid measurement has always been deemed a very important one, and most writers on the deformities of the palate have referred to it.

"Contrary to the practice of some observers, I was induced to choose the second bicuspid as the best point of observation, as it corresponds with the position occupied by the second molar of the primary dentition, and is altogether the tooth subject to the least variation of position if the changes incident to the growth of the jaw be normal in character. Whilst on the other hand, given an abnormally-developed jaw, we may be tolerably certain that the second bicuspids will to some extent be affected. The interbicuspid measurement was, therefore, taken at the line of junction of the neck of the tooth with the margin of the alveolus on either side of the jaw, this position being chosen so as to avoid the inaccuracies likely to occur in the event of a largely-developed bicuspid crown.

"At a distance from the base corresponding with the distance of the second bicuspids from the distal surface of the second molar, this interbicuspid line was allowed to traverse the triangle. These lines and distances were obtained with an ordinary pair of compasses, and measured off by means of a millimeter rule. Beyond this, the height of the palate was taken, together with the total length (in the skull), and also its transverse and antero-posterior curves.

"Thus, the deformity of the palate, arising from premature ossification of the intermaxillary or palatomaxillary sutures, would of necessity invalidate the tracings and measurements of the palate, whilst abnormally large crowns to the teeth, or extreme irregularity in the crowns, would quite as obviously render comparatively valueless the data on which the triangle was constructed. Still, if these sources of error would be fully recognized and carefully allowed for, an approximately accurate diagram may be obtained.

"My observations were in the first instance directed solely with the object of ascertaining certain normal measurements, and the first set of these dimensions were taken by means of strips of lead, accurately molded to the contour of the palate in different positions, the result being immediately outlined on cardboard; the measurements were then taken off by means of compasses and a millimeter rule. It will be desirable here to give three dimensions of the palate; viz., the width, taken from the inner margin of the alveolar process opposite to the second bicuspids; the height taken from the center of the line representing the above width to the center of the palatal arch; and the length, taken horizontally from between the central incisor sockets to a vertical line let fall from the posterior nasal spine.

"The skulls examined fall into two series: first, thirty-four adult skulls of European origin; and secondly, thirty-two adult skulls of mixed races. In the first series the average length was 49 millimeters (maximum 58 m., minimum 40 m.); the average width was 35 m. (maximum 42 m., minimum 31 m.); the average height was 9 m. (maximum 15 m., minimum 5.5 m.). In the second series the average length was 54 m. (maximum 65 m., minimum 43 m.); the average width 35 m. (maximum 40 m., minimum 29 m.); the average height was 12 m. (maximum 18 m., minimum 6 m.).

"Beyond the dimensions just enumerated, I obtained with the compasses the dental triangle to which I have already directed attention. The first set of observations having special reference to the palate, and the second to the alveolar and dental arches.

"Two main facts are deducible from the data obtained in the second instance; first: that the best type of well-developed English jaw will give an equilateral triangle as the result of measurements taken in the way I have described. Secondly: that the interbicuspid line will fall upon the triangle some five-tenths in the perpendicular from the base line, and that the extremities of the interbicuspid line will pass well beyond the boundary of the triangle on either side.

"In regard to the prognathous and upognathous jaws, we are in a somewhat more satisfactory position, and although I would not presume to speak with authority, yet I trust I may be able to put forward a case with such a show of reason as shall at least command further and patient investigation.

"My first assertion is this, that the deformity known as intermaxillary prognathism is the result of a force operating on the intermaxillary bone, such force originating in the body of the sphenoid, and being transmitted by the intervening nasal septum. (I may at once say that when speaking of force I mean a direction of growth in a given line of such energy as to overcome the resistance offered to it by surrounding structures.)

"The foregoing assertion is based upon the interpretation of the following observed facts: First, the true case of intermaxillary prognathism will have a long thin nose. Secondly, this long thin nose is not observable during the first dentition, nor is the prognathism, excepting to a very slight degree indeed. Hence we may conclude that the long thin nose and prognathous jaw are capable of intensification by growth and development during early life. Thirdly, it has been shown that the measurement from the interbicuspid line to the incisive angle is greater in the prognathous than in the normal jaw; hence it follows that the change from the normal arch occurs at a point anterior to the second bicuspids, whilst the second bicuspids are known to correspond with the position of the second molars of the milk dentition. Thus it is shown that the prognathism is not of the whole jaw carried forward on a horizontal plane,

Fig. 2.—Henry Sewill.

but is really intermaxillary or alveolo-sub-nasal in its character. Fourthly, it is simple, logical sequence of the process that produces intermaxillary prognathism, carried a step further during embryonic life, that produces double hare-lip and fissured alveolus."

Henry Sewill, on *Irregularities and Diseases of the Teeth*, 1870. A series of papers from *The Lancet* and *British Journal of Dental Science*, London, 1869, states: "Irregularities due to malformation of the jaw are now to be considered. In the recognition of these cases the point of greatest value obviously is a knowledge of the exact form of a well-shaped maxillary arch. The anterior portion of this arch, containing the incisors, canines, and bicuspids, forms an almost perfect semicircle, whilst those portions containing the molars

continue the arch backwards in slightly curved and divergent lines. Flattening or contraction of this arch, or abnormal development of any portion of it, give rise to irregularities of the teeth.

"This class of irregularities is most frequently congenital, and at the same time hereditary, a peculiar abnormality of the jaw being, in this manner, reproduced in many members of a large family. They may, however, be due to injury or other accidental causes.

"The V-shaped or contracted arch, instances of which daily present themselves, give rise to endless varieties of displacements of the teeth. The incisors and bicuspids are often forced inwards, the canines generally in the contrary direction; so that an irregularity exceedingly damaging to the expression of the countenance is the result.

"The distinction between the first and second classes of irregularity is rendered manifest by these examples, and nothing would be gained, did space allow, by multiplying them. It is evident that little can be done by the surgeon in the second class. In the treatment of this variety, it is necessary in the first place, to consider the desirability of extracting teeth for the sake of obtaining space. Secondly, where teeth must be sacrificed, it is necessary to decide which of them can be removed with the greatest advantage. Next comes the question of the extraction of such malplaced teeth as are not amenable to mechanical treatment. Lastly, there is the designing and construction of the mechanical apparatus required for the completion of the cure. With the many details here involved, none but those who make dentistry a special study, can be expected to be practically acquainted, and these cases must, therefore, be considered almost altogether beyond the province of the medical practitioner.

"A few remarks on the mechanical treatment of irregularities may be added in conclusion. They will be of service in determining the cases which are capable of being either improved or cured by the application of apparatus.

"Instruments for the purpose of altering the position of malplaced teeth are constructed to fulfill two objects: to prevent the locking together of the teeth on closure of the mouth, and to exert such continued pressure or traction on those teeth which are irregular that they may be gradually compelled to assume a normal position. To fulfill these objects, a plate of metal or of vulcanized india-rubber is accurately adapted to the teeth and palate, the molars being covered with sufficient thickness to prevent the front teeth from meeting. A fixed point is thus formed, to which springs or levers, elastic bands or wedges of wood, may be attached in any desired situation. These may be arranged to exert, with great nicety, any amount of force required, and to effect the desired result without exciting unnecessary inflammation.

"This was an irregularity of the first class, one lateral incisor being displaced inwards, and held in its malposition by the lower teeth on closure of the mouth. The plate covering the molars kept the jaws sufficiently apart to prevent the front teeth from meeting. The obstacle to the forward movement of the tooth being thus removed, but a slight amount of pressure was required to force it into its normal position. To obtain this pressure a piece of compressed hickory was fixed between the plate and the back of the tooth. The moisture of the

mouth caused the wood to expand, and in expanding, to drive the tooth slowly in the desired direction. The wood was renewed by larger pieces at intervals of a day or two, as the cure progressed, until at length, the teeth have assumed the regular appearance.

"This case is of a different character. It consisted of a vulcanite frame, closely in contact with the inverted angles of the teeth, but clear of the rest of their surfaces. From each side of this frame there proceeded a flat spring of hard gold wire, and these, extending round in front, were arranged so that their free extremities kept up constant pressure on the everted sides of the irregular teeth. By this means the distorted incisors were compelled gradually to revolve, and in a comparatively short time the deformity was entirely removed.

"By similar contrivances the alveolar border, and even the whole jaw, may, when necessary, be modified in form. For instance, in the contracted or V-shaped palate, an apparatus would be made to maintain equal pressure from within outwards along the alveolar margin. In time the required expansion of the arch would be accomplished.

Fig. 3.

"Other cases may be advantageously dealt with by instruments fixed externally. Thus the case would be treated by a constant upward traction of the chin, a cap of leather adapted to that part being attached to a strap across the head by strong elastic bands at each side.

"This apparatus and its application are shown in Fig. 3.

"The almost marvellous manner in which the jaws may be modified in shape by the continued application of force in one direction, is not uncommonly illustrated in surgical cases. The sequel of extensive burns of the front of the neck furnishes, occasionally, an instance in point. The cicatrix resulting from such injury has a constant tendency to contract. It draws the chin unceasingly toward the chest, and in time causes the body of the jaw to curve downwards.

"From a consideration of the principles upon which the mechanical treatment of irregularities is based, it will probably suggest itself that this treatment can be much more rapidly and effectually carried out in the child than in the adult. At the age at which the alveoli are in process of growth, and when they do not closely embrace the teeth, a malplaced tooth can be drawn into position in

a short time, and with the exercise of but slight force; whereas in the adult, the bone being consolidated, the process is long and tedious. For the same reasons, the cases in which the shape of the jaw has to be modified are much more amenable to treatment at an early age than at a later period, when the osseous system is fully developed. If, therefore, the opinion be formed that the treatment of a case of irregularity can not be undertaken without mechanical aid, no time should be lost in the construction and application of the necessary apparatus."

D. Hepburn before the Odonto-Chirurgical Society, published in the *British Journal of Dental Science*, page 264, on *Irregularities of the Teeth and Their Treatment*, said: "In order to simplify the subject for which purposes of dis-

Fig. 4.—D. Hepburn.

cussion I have arranged it under three heads; viz., the cause, treatment, and the instruments made use of for the cure of these deformities.

"It seems to be generally accepted as a fact, that this particular deformity is the result of the artificial life and the other causes attendant upon civilization.

"I shall only call your attention to one more theory in which it is affirmed that the premature extraction of the temporary teeth permanently contracts the jaw, while I do not for a moment suppose that any positive contraction of the jaw or alveoli takes place.

"Independently of those influences, the action of which is doubtful, and there are causes familiar to us all, which are at once active and direct in their effects upon the developing teeth, such as the presence of supernumerary teeth, the nonabsorption of the roots, and retention of the temporary ones, the

irregular antagonism of the upper and lower sets on closing the jaws, etc. We have also those of hereditary character, as exhibited in such cases as are marked by the absence of certain teeth in some families, or by the peculiar formation or malposition of one or more in others, the origin of these conditions being as obscure as some of which we have been treating.

"For the reduction of this deformity there are two lines of treatment usually followed, the surgical and mechanical, though in many cases it is found necessary to take recourse to both.

"In undertaking the treatment of these cases we have to consider the form of palate, whether it be of a hereditary character and is the result of a defective or undue development of the jaws or alveoli, or whether the deformity simply arises from malposition in the teeth themselves, or whether we shall treat them at all, must very much depend on these conditions. If arising from the former, the cure may even, if successful, assume a long and protracted character, if from the latter, it is usually of a more simple kind, and more readily mastered.

"Before doing so, however, I should wish briefly to state what I consider to be essential characteristics of regulating frame. While it is absurd to say that any particular form of instrument was the best for all cases, there are nevertheless certain points which ought to be possessed by all, if we hope to make use of them with effect. In the first place they ought to be as simple as possible in their construction, and free from all complications. There action ought to be at once decided, continuous and direct, without being harsh; they should be as small and as light as we can make them, consistent with the purposes they have to fulfil, when in position they ought to be fixed and steady, so that we may have a reliable foundation on which to work and to which we can attach our clasps, springs or other moving powers; any rotary or motion will at once interfere with their action and delay the progress of the cure. I think it also essential that the patient should be able to take them out and replace them at pleasure; this enables them to keep the mouth clean, and lessens risk of injury to the other teeth from the food or morbid secretions of the mouth accumulating about the frame. We must all have seen frames which have been tied in, come back in the most offensive state, for this and other reasons I object to the use of ligatures, which are not only apt to irritate and inflame the gums, but as has been clearly demonstrated by the valuable experiments of Mr. Bridgemen, they excite an electrolytic action, which decalcifies the enamel, and is most destructive to the teeth around which they are tied.

"An ingenious application of the principle of the inclined plane has been illustrated by Mr. Fletcher, in a paper read before the Odontological Society, in which he says: 'A modification of these plans I made use of some years since, in this I capped with gold the back teeth of the under jaw, uniting the caps on both sides of the mouth by a narrow, stout, gold band, passing in front and resting against the anterior teeth, to the buccal sides of the caps; to the side of the first molar was soldered a stout piece of gold plate, projecting upwards about half an inch, cut at about an angle of sixty degrees, sloping upwards from the bicuspid to a parallel line from the middle of the molar. The upper

plate was made capping the back teeth and covering a portion of the lingual surfaces of the anterior teeth. A small thick piece of gold was soldered to the buccal sides of the caps, into which was screwed a strong gold pin, which on any effort to close the mouth, rubbed against the inclined edge of the under piece forcing the under jaw back. As the caps came into contact the points were filed away until the teeth themselves nearly met. In the course of about three weeks the under teeth were, on closing the mouth when the apparatus was out, fully one-eighth of an inch within the upper, being previously more than double that distance beyond the upper teeth. This I adopted in preference to the strap on the chin and strong elastic bands carried to the back of the head, which I found considerably increased the inconvenience to the patient and was much less effective in operation.

"The frame which I am in the habit of making use of is simply one of these covering the palate and crowns of the teeth, with the addition of metal clasps which passes over the cutting edge and labial surface of one or more of them, its position depending upon the character of the case, and the teeth to be operated on; it is to these clasps that I wish to call your attention, as it is this which gives the distinctive character to this frame, and it is surprising the uses, and variety of cases to which it can be adapted.

"Its primary object in cases of instanding teeth is to sustain the frame firmly in its place, but it also acts with the plugs and the teeth to be moved, thus by a double action assisting in the cure.

"In cases of outstanding teeth it is made to overlap them, and by its simple action it gradually, but surely, presses the offending teeth into the desired circle; as they move the clasps are tightened, which, in many cases, may be done by the patients themselves.

"In cases of torsion it is made to press upon the outstanding labial angle of the tooth, while a plug of wood acts upon its inner palatal angle; the plug is lengthened and the clasp is tightened as the teeth move around, which they gradually do under their combination action during mastication, etc."

John Hugh McQuillen, 1826-79, in the *Dental Cosmos* of 1871, page 513, under *Influence Exerted by Antagonizing Teeth in the Maintenance of Dental Irregularities*, says: "The influence exercised by the lower incisors in maintaining a false position of the superior incisors, when the latter strike inside of the former, has been noticed by everyone who has paid any attention to the subject; and the fact is fully recognized that the first indication in attempting to correct the difficulty is to prevent the unnatural occlusion, as all efforts to bring them into their proper position would otherwise prove unavailing.

"Judging from some cases, however, that have come under my observation, in which efforts have been made to correct a malposition of the superior canines by extracting the neighboring bicuspids, it would seem that the direction and influence of the force exerted by the inferior antagonizing bicuspids had not been sufficiently considered, or perhaps not even thought of.

"For instance, when the superior canines project outside of the arch, not unlike tusks, and the other teeth are very much crowded owing to the small size of the jaws, it was formerly the invariable practice to extract the neighbor-

ing bicuspids to secure sufficient room for the canine to fall into position. In many cases this course was not only unwarrantable but decidedly reprehensible practice, from the fact that valuable teeth were frequently and uselessly sacrificed. This has been proved by the introduction of improved appliances for enlarging the arch in other cases, gaining thereby sufficient room for the canines to fall into proper position without the loss of a single bicuspid.

"In some instances, however, the necessity of sacrificing the bicuspids is imperative, and it is to just such cases that attention is now invited, as it becomes a matter of question frequently under such circumstances to decide whether the first or second bicuspids should be removed to secure desired room. The usual practice advised and followed is to extract the second bicuspids, under the impression that ample room can be obtained, and without a V-shaped

Fig. 5.—John Hugh McQuillen (1826-79).

space (with the base toward the gum, favoring the retention of food) being formed between the canine and second bicuspid, as, is asserted, is apt to be the case after the removal of the first bicuspids.

"On examining the articulation of a perfect and regular set of natural teeth, it will be found that the teeth of the upper and lower jaw are arranged in such a manner that, owing to the difference in size, the superior incisors and canines, when the jaws are closed, lap over the upper third of the anterior surface of the inferior incisors, canines and half of the first bicuspids, while the crowns of the first superior bicuspids antagonize with the posterior half of the first and the anterior half of the second inferior bicuspids. This peculiar antagonism of the crowns of the bicuspids is continued to the molars, so that 'no two teeth oppose each other only, but each tooth, in closing the jaws, impinges upon two; so that, should a tooth be lost, or even two alternate teeth,

still the corresponding teeth of the opposite jaw are to some extent opposed, and thus remain useful. For when a tooth is wholly unopposed, a process is set up in the jaw by which the useless organ is gradually ejected.'

"This order of antagonism is, of course, materially modified in irregular dentures, particularly when the superior canines are outside of the arch, and the first bicuspids are in close proximity to the lateral incisors. In such a state of affairs the inferior first bicuspids will be found impinging on the posterior half of the first and the anterior half of the second superior bicuspids, and, as in closing the lower jaw, the direction of the force being upward and forward, the shock of occlusion tends to maintain the irregularity, even after the removal of the second bicuspids. The influence of this shock can be properly estimated by referring to cases where bicuspids or molars have been driven into the most peculiar positions, after the loss of adjoining teeth, by the direction of the force exerted by the antagonizing organs.

"The importance of taking this matter into consideration in deciding upon the question must be conceded, and where the occlusion of the bicuspids is such as to maintain the irregularity by driving the first superior bicuspid forward, those teeth should be removed in preference to the second bicuspids."

Before the Odontographic Society of Pennsylvania, *Dental Cosmos,* 1872, page 604, Dr. McQuillen, in discussing a paper, said: "It was difficult to form an opinion as to what plan of treatment would be the best to adopt in treating a case of irregularity of the teeth, when the conclusion had to be arrived at merely from an examination of plaster models. An inspection of the mouth and a view of the features of the patient, in person, or by means of a photograph, was a necessary aid in forming a correct diagnosis. He had frequently been consulted by fellow-practitioners residing at a distance, who had sent plaster models by mail, but none of them had ever thought of forwarding photographs of patients. The age of the patient, the laxity or density of the tissues, the constitutional peculiarities, were points on which one should be informed and this could be best acquired by personal interview. With these drawbacks he would suggest the introduction of a piece of hickorywood between the superior laterals to act as a wedge and force them past the central incisors, and then would use the silver bar and rubber ligatures, as proposed by him in 1859, in the *Dental Cosmos,* Vol. 1, page 183, the ligatures being attached to the laterals, so as to draw them into their proper position in the arch. During all this time an inclined plane made of hard rubber and fitted to the lower teeth would materially aid in forcing the laterals in their position."

J. Langdon Down, 1871. Odontological Society of Great Britain, 1872, *On the Relation of the Teeth and Mouth to Mental Development,* wrote: "The excessive vaulting of palate is due to the arrest of development of the sphenoid or defective growth of vomer. They are developmental defects and are caused long before the time when nursing is practiced, unless that habit be an intrauterine one.

"A marked character of the teeth of idiots is their irregularity as to position. They are often crowded, so crowded as to present their sides instead of their anterior surfaces. They are often arranged on different planes. The

canine teeth are frequently unduly prominent, and a marked sulcus is sometimes seen between the incisors and canines, with prominence of the incisors. . . .

"Of the most significant value, however, is the condition of the palate. I have made a very large number of careful measurements of the mouths of the congenitally feeble-minded and of intelligent persons of the same age, with the result of indicating, with some few exceptions, a markedly diminished width between the posterior bicuspids of the two sides. . . .

"One result, or rather accompaniment, of this narrowing is the inordinate vaulting of the palate. The palate assumes a rooflike form. The vaulting is not simply apparent from the approximation of the two sides; it is absolute, the line of junction between the palatal bones occupying a higher plane. Often there is an anteroposterior sulcus corresponding to the line of approximation of the two bones. . . .

"An appeal to the condition of the mouth is an important aid in determining whether the lesion on which the mental weakness depends is of intrauterine

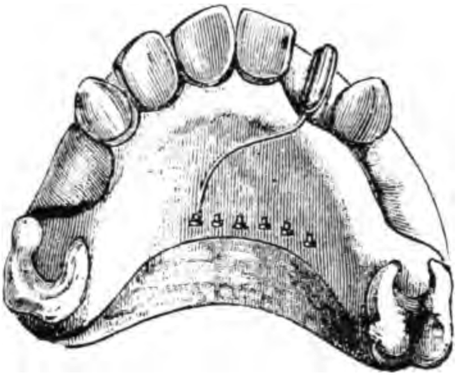

Fig. 6.—Langsdorff's method of rotating teeth (1863). (Magetot.)

or postuterine origin. In the event of the mouth being abnormal, it indicates a congenital origin; while if the mouth be well formed, and the teeth in a healthy condition, it would lead to the opinion that the calamity had occurred subsequently to embryonic life."

A. H. Fuller, in the *Missouri Dental Journal,* 1872, published a new method of making a coil wire band, describing his method in the following way: "In 'regulating cases,' having at times found it extremely difficult to perfectly fit a band to a tooth which I desired to twist, it occurred to me that the difficulty could be overcome in the manner which I will describe and which I have since found of great advantage, saving time and patience, and giving a more accurate adaptation than could be obtained by any other method with which I am acquainted.

"I take an impression of the tooth, from which I get a plaster model; around this I wind a fine platinum wire, one coil above the other, until a band of sufficient width is formed. Over this, and while yet on the plaster model, flow gold solder, and you will have a perfect fitting band. Attach your catches at whatever points on the band you wish to apply your force by solder-

ing on a small piece of plate, or in any manner the case may suggest to your mind as the best.

"Clasps can be perfectly fitted to teeth in this manner, using heavier wire and twenty carat gold for solder, cutting the band so as to clasp the tooth in the proper manner."

Thomas C. Stellwagen, before the Odontographic Society of Pennsylvania, in discussing a paper reported in the *Dental Cosmos*, page 605, 1872, saying: "Study the patient's features both full face and profile, noting any defects that may be apparent. Many times protracted suffering, and even serious injury, may be avoided by remembering that it is unnecessary to expand the alveolar arch simply to get the whole of the teeth in position, where it is large enough to harmonize with the face and does not impair the voice or mastication.

"While it is questionable or even bad practice to preserve useless teeth, always remember that it is rare that any of the six anterior teeth can be removed without serious deformity resulting from the loss. The first or second bicuspids from their liability to disease, their secondary importance in speech, expression, or mastication, and, finally the spaces left after their extraction, being so easily filled and so frequently sufficient for the purposes of the orthodontist, are all sufficient arguments for the sacrifice of these organs in preference to others.

"The occlusion of the teeth, the manner in which they tend to interfere with the movement of each other, also the proposed occlusion to be gained after the treatment has been completed, should be taken into account.

"The occlusion of the teeth has more to do with their moving than any power that could be produced either with a plate or ligatures."

Wm. A. Breen, in the same journal, said he "had a case similar to the one under consideration. He used whalebone in place of wood, as suggested by Prof. McQuillen, and then used an incline plane upon the laterals until they were forced between the cuspids and centrals; then removed the plate, and allowed them to fall into the arch of their own accord, which they did very satisfactorily."

Robert Baume, in *Vierteljahrsschrift, für Zahnheilkunde*, 1872-73, and translated in the *Monthly Review of Dental Surgery*, Vol. 2, has a series of articles on the *Eruption of the Teeth*. He takes exception to the theories of Wedl and Tomes but adds little that is really new.

J. T. Browne-Mason, on the *Irregularities of the Teeth*, published in the *Transactions of the Odontological Society of Great Britain*, page 161, 1872, treated the subject in the following manner. He divided the subject into two heads: "First, the treatment of cases not requiring mechanical appliances; secondly, cases that need such aid.

"The first-named cases are frequently the result of the crowding of the teeth by pressure forwards of the back teeth.

"With regard to the treatment of irregularities caused by insufficiency of room. To get the offending teeth into the dental arch, it is clear that we can only make room for them by the withdrawal of others.

"The bicuspids, unless their space has been lost by the early removal of

the milk molars, find their way into their normal places without much trouble, for their predecessors leave them abundance of room. Should they, however, be pushed out of place, I should not hesitate to remove the bicuspid, for its room would, under the circumstances, be an advantage.

"The canines are very frequently thrust out of the dental arch by want of room.

"My mode of procedure is to leave the six front teeth intact, and sacrifice a bicuspid, or first molar, on each side. Which of the two is to be the tooth sacrified must depend on circumstances.

"Now, with regard to the treatment by mechanical aid. I find the cases in which the lower jaw requires such assistance so rare that I can not give any examples of it, for I have almost invariably found that when there is sufficient room in the lower jaw the teeth will arrange themselves.

"You will find that most of the irregularities of the lower jaw will be reduced by nature, provided, as before said, there is room in the jaw.

"Our model being taken, the tooth or teeth must be turned and corrected on it, and then a plate fitted accurately round the inside of the incisors, coming quite to the inner edge of these teeth, capping the temporary molars, and extending back over the masticating surface of the permanent first molars, to prevent these teeth rising in the jaws whilst the plate is worn, which would interfere with the bite when the plate is left off. The caps must go well under the gum of the temporary molars, so as to firmly grip the necks of these teeth, otherwise the plate will not be perfectly steady, but apt to slip: there should be a piece of plate to thicken the caps over the grinding surfaces, and this thickening should be considerable over the first temporary molar, and less over the second temporary molar, ceasing with that tooth. If this extra thickness is not placed on the caps, you will find, when the plate is in the mouth and the mouth closed, there will be no bite except on the last teeth on each side, and the patient would then have difficulty in masticating whilst the plate is worn. I like to have the bearing hard on the first milk molar, and if found too hard on that tooth a sharp sculptor will soon remove the points borne on, for after our plate is in its place, as will presently be seen, it should not have to be removed for some time. A bar must also be carried from first molar to first molar, fitting close to the outside of the central teeth, to keep them steady when turned. When the plate is ready, I seize the tooth or teeth with a pair of forceps, like a pair of broad, flat pliers, the biting surface of the jaws of the instrument being covered with lint or chamois-leather, to prevent injury to the enamel of the teeth. Then, with a steady twist I revolve the offending tooth or teeth in their sockets, and immediately place on the plate, and the work is done. I have never seen any unpleasant effects from the torsion in this way, the pulp not being injured by the process.

"Case No. II. I fit a plate as already described, only without tampering with the cast in any way, a screw being brought to bear on the teeth that require correction at about the point where the disto-lateral and lingual surfaces of the tooth form their junction, whilst a rigid bar is carried round from the first molar to determine the degree of prominence, in order that the teeth may

not, by the pressure of the screw, be thrust too far out, but, by the restraining action of the bar, be revolved on their own axes when the desired prominence is gained. The screw should be turned every morning and evening if practicable, until as much pressure is produced as the patient can bear; if necessary, the advancing tooth must be followed by building up plate behind it, a fresh screw being inserted as required. By this means, in nine visits, extending over seven days, a complete correction was made of the offending teeth in the case before you. After the teeth are in position, I take a fresh cast, and adjust my plate and bar to retain the teeth in their places; the apparatus is then worn by the patient for four to six months, to ensure the teeth retaining their new positions, the hold of the caps having been slackened to allow the patient to remove the plate for the purpose of cleansing it and the teeth. (See Fig. 7.)

"I prefer the use of the screw to compressed wood, for the latter I found occasionally slip out of position, besides being much slower in operation; and I have a great preference for speedily finishing such cases, as it must necessarily be less trying to the patient, whilst the permanence of the work is not affected by it. I also think the screw more desirable for bringing teeth for-

Fig. 7.

Fig. 8.

ward than the inclined plane placed on the lower teeth; for, by the latter plan, the patient has constant worry, and more especially during meals. From the molar teeth having no bearing, all mastication during the period of the moving the teeth being perforce most imperfect, and the discomfort, to say the least, at those times of the teeth under treatment, tender as they are, striking on the inclined plane, is, I think, much more trying than the pressure of the screw, which only causes discomfort and pain at the time it is moved. Actual torsion should be performed as early as practicable before the root of the tooth has completed its growth. (See Fig. 8.)

"Plate of either gold or dental alloy is more manageable than vulcanite, as it is easier to follow up advantages gained by building up plate than by taking a fresh cast, and by making almost a new frame when the changes of the mouth require it."

L. Fleschmall, in *Wiener Med. Wochenschrift* (*Dental Cosmos*, 1873, page 261), under *Irregularity of Teething Diagnostic of Rhachitis*, calls attention to how seldom this subject is alluded to and claims rhachitis can be hereditary or acquired. It is with the latter class that the author has to do, and it is

the most frequent form, affecting nearly one-third of all children. Rhachitis is due to a peculiar disturbance of nutrition in a growing body, a "dystrophy," amenable with more or less success to treatment at the beginning. Children nourished artificially are, for obvious reasons, more liable to it than those brought up at the breast, and the latter, when affected are generally so after weaning; that is, after the tenth or twelfth month.

"The teeth come first in the order of the bones affected, and the disturbances, therefore, in the ossification of the teeth can serve as a valuable sign of a very important disease. The formation of the embryo of a tooth commences in the second month of foetal life, and in the middle of the third month is completed for all the teeth. The milk-teeth are formed in the fifth month, and are so far advanced at birth that the crowns of the incisors and first molars are completely developed; those of the canine and posterior molars one-third formed. As the acquired rhachitis, according to experience, rarely comes on before the end of the sixth month, and most frequently in the latter part of the first year, reaching its highest point between the second and third years, it follows that, if we place the appearance of the first teeth at the seventh month, the rhachitic process will not have had any influence upon these. The only exceptions to this are when a hereditary rhachitis makes rapid progress immediately after birth, or when the infant is weaned very early, and is brought up with improper food; in such cases it happens sometimes that one waits in vain for the appearance of the first teeth and sees a year or more elapse. In the majority of cases rhachitis shows itself first after the breaking through of the first molars."

Joseph Richardson, before the Odontological Society of Pennsylvania (*Dental Cosmos,* 1873, page 350), in a paper *Treatment of a Case of Irregularity,* explained the following method of handling these cases, first extracting the first bicuspid and then a narrow band of vulcanized rubber (Fig. 10) was constructed embracing the six anterior teeth. "Pressure was made upon the misplaced teeth by means of wooden pegs inserted in holes drilled through the band, at such points as were indicated by the direction in which it was desired the teeth should take. In the present case the pegs rested against the posterior mesial angles of the lateral incisors in such a way as to force them, when the band was applied, outward and backward, while those inserted into the opposite or labial portion of the band carried the cuspidati backward and inward. These pegs projected but slightly at first, and were lengthened from time to time, as the teeth moved, their removal and replacement being but the work of a few minutes. Before applying the band, all connecting partitions of rubber were divided, and the band cut away sufficiently at necessary points to enable the teeth to move in the desired direction. In most cases this band may be removed and replaced by the patient for the purpose of cleansing the teeth.

"The mechanical action of this simple fixture is readily apparent. The band, when applied, being forced apart by the intervention of the pegs, acts, by virtue of its elasticity, as a clamp, or compressor, forcing the teeth in a direction opposite the insertion of the wooden pins.

"I found the case now complicated with a marked elongation of the lateral incisors.

"Without any published precedent, so far as I am aware, I entered upon the novel undertaking of shortening (relatively) the elongated teeth in question, by pressure applied on a line with their long axes. To this end, a plate affording fixed points of resistance was constructed, having clasps attached and pinned to the centrals with wooden pegs resting against their anterior, and the plate against their posterior surfaces. To this plate firm elastic cords were attached, stretching across the openings for the lateral incisors. When this plate was pressed firmly to its place upon the teeth, and held securely by the means already adverted to, the contractile force of the cords, acting forcibly and persistently upon the cutting edges of these teeth produced the requisite short-

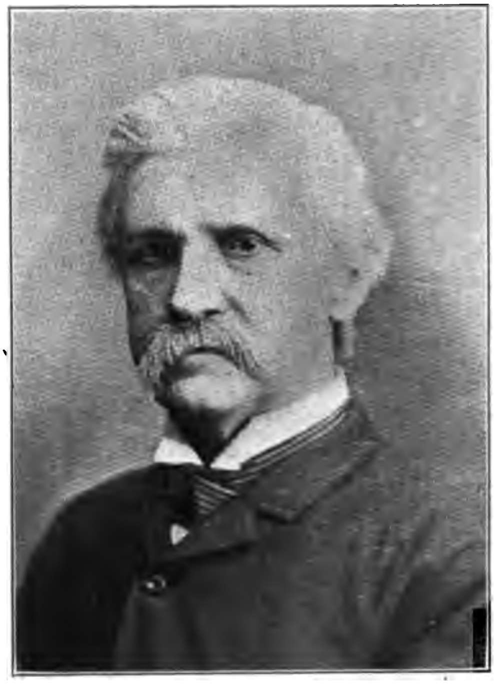

Fig. 9.—Joseph Richardson.

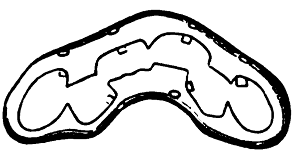

Fig. 10.

ening. During this time pressure was also being made upon the cuspids, which, in addition to forcing them further backward and inward, assisted in fixing the plate in aid of the shortening process.

"Finally, a plate was made, resting accurately against the posterior faces of the central and lateral incisors, and cut away somewhat posteriorly to the cuspids, to enable the latter to drop down until they shall become symmetrical in length with the adjoining teeth."

D. F. Drake, before the American Dental Convention, 1873, read an essay on *Orthodontia*, saying that "he thought that orthodontia meant something more than the mere application of appliances to the teeth to throw them into

their proper position. The conditions to be desired are: (1) Youth or proper age; (2) health of the parts; (3) absence of syphilitic taint, hereditary or otherwise; (4) absence of scrofula or struma; (5) absence of all scorbutic tendencies; (6) absolute cleanliness; (7) confidence of patient. All these things being conditions favorable, success is certain. Remember that the simplest method is always preferable. With the appliances nicely adjusted and carefully watched, the carrying of the teeth to their proper position is an easy matter. This must be done neither too fast nor too slow, for either will jeopardize the operation. There is little danger of moving too fast if it is done steadily. A steady, firm pressure will provoke much less inflammation than an unsteady, oscillating movement. Move the teeth as fast as it is possible without injuring

Fig. 11.—Charles S. Tomes.

the pulp. It is quite common for children to inherit large teeth from one parent and small maxillæ from the other. In such a case an enlargement of the maxillæ must be obtained, but not until the majority of the second teeth have made their appearance. This contraction of the maxillæ is almost invariably associated with irregularities of the teeth."

Charles S. Tomes, in the *Dental Cosmos,* 1873, page 292, in an address before the Philadelphia Dental College on *The Bearing of the Development of the Jaws on Irregularities,* stated: "Teeth when they are erupted *do not come down and take their places in a bone already prepared for them;* on the contrary, that which is there to start with is absorbed, and the bone in which they are ultimately implanted is built up *around them, no matter what position they*

may assume subsequently to their eruption. And the inference to be drawn from these facts is tolerably obvious; namely, that premature extraction or the temporary extraction of the temporary teeth is perfectly unable to be the cause of contraction of the jaw. For, unless the bony bar which lies below our imaginary line be distorted, it matters very little indeed what happens above it, so long as the permanent teeth meet with no obstruction during their exit from their cysts.

"Now the case is very instructive, for it shows very plainly that contraction of the jaw is by no means a necessary sequence of early removal of deciduous teeth, but that on the contrary, every single one may be removed, and yet the jaw become of full size and the teeeth be arranged with perfect regularity.

"Along the outside of the dental arch the muscular structures of the lips and cheeks are perpetually exercising pressure perfectly symmetrically, and on the inside the tongue is with equal persistency doing the same thing. Now if we imagine a plastic material placed between the tongue and the lips, it can not fail to be molded into the form of a regular dental arch, and this is precisely what happens with the mobile, freshly erupted teeth; and should it chance that an individual tooth becomes deflected by some obstruction, so that it stands outside or inside its neighbors, it will obviously come in for more than its due share of pressure, and so soon as the obstruction is removed, will be pushed into place. And as the muscular action of the tongue is more powerful than that of the lips, a tooth which stands inside the arch is reduced to its proper position more quickly than one which lies outside. There is, I believe, no such thing as a natural tendency towards the assumption of the regular form in a dental arch; the physical forces at work, namely, the lips and tongue, are amply sufficient to account for all the phenomena observed; and explanations based upon such a tendency fall, like references to 'vital force' as an explanation of physiologic phenomena, into the category of mere forms of words calculated to cloak our real ignorance.

"Certain cases known as V-shaped contracted jaws likewise illustrate the power of the pressure of the lips and cheek to modify the position of the teeth, for it will generally be found that this malformation is associated with greatly enlarged tonsils, which necessitate breathing being carried on with the mouth open. Now, as every one can easily verify upon himself, the effect of the mouth being held open is to increase the tension of the soft parts about its angles, and the result of the increased pressure is to bring about a bending inwards at the corresponding point; i. e., the bicuspid region. At the same time, the median portion of the arch escapes the controlling pressure which would have been exercised by closed lips, and the effect of this is traceable in the excessive prominence of the median pair of incisors, and also in their oblique positions, which makes them correspond with the form assumed by the inner surface of the lips when the mouth is open.

"The association of this form of contracted jaw with congenital idiocy, as well as some other considerations, lead me to infer that the contraction of the face of the jaw is due to causes in operation from a very early period; but the

agency of the lips and tongue is that which determines the position of the teeth themselves."

In the *British Journal of Dental Science*, May, 1873, page 200, in describing *A Case of V-shaped Contracted Maxilla, in Which There Was a Wide Separation Between the Upper and Lower Front Teeth,* Dr. Tomes said: "Mouths in which the back teeth alone antagonize, and the upper and lower front teeth fall short of meeting one another, are not very uncommon.

"The upper jaw presented the ordinary form of a V-shaped maxilla, the central incisors meeting one another at an angle, their mesial edges being greatly everted and overlapping one another, and the palate being excessively deep and narrow. When the mouth was closed to the utmost extent possible, a gap of $\frac{4}{16}$ of an inch intervened between the edges of the upper and lower central incisors, of $\frac{3}{16}$ between the right laterals and the canines, and of $\frac{2}{16}$ between the left laterals, while the left canines occupied a position (relatively one to another) too irregular to admit of exact measurement. Behind the canines the upper and lower teeth came in contact with one another, but their disposition was very irregular. Thus the second upper bicuspid (the first having been previously removed) bit inside the corresponding lower tooth; whilst of all the teeth in the upper jaw the second molars were the only ones which preserved their normal relations by biting outside the corresponding lower teeth. It was therefore necessary to move outwards the central and lateral incisors, the canines, and the second bicuspids on both sides. The first stage in the treatment was to expand the arch of the upper teeth.

"The first upper molars, being excessively carious, and often painful, were extracted, and a vulcanite plate was then inserted, which forced the bicuspids outwards by means of wooden wedges, whilst at the same time it disengaged them from the cusps of the lower teeth by means of gold caps fitted over the second molars so as to prop the mouth open. It should be added that the removal of the first molars did not enable the front teeth to be approximated any more closely than before.

"As soon as the bicuspids had passed out, so as to bite outside the lower teeth, this plate was abandoned in favor of one with a stout gold wire passing outside the incisors, canines, and bicuspids, and being attached to the vulcanite plate in the spaces left by the extraction of the first molars.

"To this band, which had been rendered elastic by hammering, the central and lateral incisors and canines of both sides were firmly attached by silk ligatures, the band being pressed inwards towards the teeth by the finger of an assistant, while each ligature was being tied.

"The effect of this was to draw the teeth outwards rapidly, and to make the front of the arch rounded in the place of having the angular form characteristic of the V-shaped jaw, so that the upper teeth assumed a perfectly regular position amongst themselves.

"As soon as the upper teeth had been drawn outwards so that the arch was wide enough to allow of their passing outside the lower teeth, pressure was brought to bear in order to close the front part of the mouth by means of a simple arrangement of elastic bands.

"A circular air-cushion was adapted to the chin and connected by strong pieces of elastic with a cloth band passing over the top of the head; the whole was kept in place by two pairs of ribands which were tied at the back of the head. (Fig. 12.) At first some little trouble was experienced, owing to the skin of the chin becoming tender under the heavy pressure; but this was combated by the use of spirit lotions, and by putting slightly oiled lint between the air pad and the skin. This apparatus was worn constantly at night, and also during a considerable part of the day, the teeth being kept from falling back into their former positions by a light retaining plate. At the time when this apparatus was first adjusted the only teeth which came into contact were the upper and lower second molars and second bicuspids.

"For a few weeks no very marked effect was produced save slight pain in the region of the temporomaxillary articulation; but after that the gap between the upper and lower incisors diminished each week by an amount that could be

Fig. 12.

measured, and the expiration of six months from the first commencement of treatment (the elastic bandage having been worn for about four months), not only had the gap entirely closed, but the upper central incisors had been made to overlap the lower to the extent of $\frac{1}{16}$ of an inch, while, as may be seen in the accompanying figure, the laterals and the canines also overlap and antagonize."

In the same journal June, 1873, page 245, *Alfred Alex. DeLessert,* in speaking of *The Results of Fruitless Thumb-sucking,* concluded his article by saying:

"But though fruitless sucking has undoubtedly its many attendant evils, this most natural habit must surely have its attendant benefits if not carried to the excesses I have alluded to; and I think there is little doubt but that the pressure exerted by the tongue, thumb, finger, or hand, materially assists in the development and expansion of the jaws; for it is an undoubted fact that most of the V-shaped palates and mouths with crowded teeth so often placed under

a dentist's care for regulation are found in patients suffering from enlarged tonsils, and whose respiration through the nares is almost an impossibility, so that an open mouth is necessary, and thus the dental arch is allowed to contract without any opposing force."

William Barkley, in speaking of *Pegs vs. Screws in Cases of Torsion*, page 307 of the *British Journal of Dental Science*, 1873, takes exception to *Browne-Mason's* claim "that torsion was practiced only by Sheffeld and his pupils.

"As regards the discussion as to the advantage offered by pegs over screws, and vice versa, my own experience is decidedly in favor of pegs. I have more than once seen the enamel strained by the undue pressure of screws, and if we furnish our patients with such powerful means as a screwdriver to perform their own dental regulations such a result is not to be wondered at. And I must quite disagree with the gentleman who stated pressure by pegs is not continuous; if such is ever the case it is only because they are applied in a manner ill calculated to effect the object in view. The first step towards success is to obtain a perfectly firm fit of the plate, without bands or clasps for if such are used when pressure is applied, they can hardly fail to act injuriously on the teeth they embrace. My plan, which I do not offer as being particularly novel, is to strike the plate entirely over the molars, first covering the same with sheet lead sufficiently thick to admit of platina gauze being soldered on the plate, on which gutta-percha is imbedded; the plate is then placed in boiling water, and the patient directed to bite it steadily into place; it will be found to fit so firm as to require some force to remove it, and in this condition it should be allowed to remain for a short time; in fact until the patient has become accustomed to it, the cells for the pegs are of course already soldered to the plank. In a day or two the pegs may be added, but left $\frac{1}{16}$ or $\frac{1}{8}$ of an inch too long, the plate not then touching the entire palate by a distance equal to the excess of the pegs."

S. J. Hutchinson describes *A Simple Method of Correcting Irregularities* in the above journal, page 401. "In order to test the value of such a method as is now to be described, the requirements necessary to treat a case of irregularity may be mentioned to see how far this may fulfill them.

"1. As to its efficiency in moving irregular teeth.

"2. Whether it is comfortable to wear.

"3. Is it easily made and easily adjusted?

"Lastly. As to the length of time it is kept in place, and how frequently the patient must see the dentist.

"A plate to fit the palate extending as far back as the first molar may be made of vulcanite or gold, the former preferably with a plain round gold wire, pin size, extending outside the arch of the teeth, not quite touching them, and on a level with their necks, each end embedded in the vulcanite, going either behind the last molar or even between the molars, or bicuspid and molar, or through any space caused by extraction.

"Should any of the upper teeth fall within the lower arch of course the back teeth will require capping, and to the caps the wire may be fixed. The plate will now fit in the mouth quite firmly, and the means of moving the mis-

placed teeth can be adjusted without making the plate much more uncomfortable than an ordinary artificial denture is at first.

"It is only necessary to use a small elastic ring, either an ordinary regulating ring as supplied by the depots, or what I find answer better, keeping the contractile force longer, slices of India rubber tubing, such as is used for the ether spray.

"The ring is first put around the neck of the irregular tooth then the plate is put in; the ring is now stretched forward above the gold wire, brought down over it and back again over the tooth. This can only be done when the teeth are fully erupted and well developed, for should they be very short and inclined outwards it is better to put a small stud in the plate behind the tooth to be moved to hook the ring over, though then only two strands of elastic are at work, whereas, in the first case, four strands are dragging vigorously, but steadily, at the tooth; sometimes, also, it is requisite to tie floss silk or gilling twine to the ring and then round the neck of the tooth to prevent its slipping off. Another way of fixing the ring in the palate is to drill two small holes side by side, countersink between them on the side next to the palate, and tie the ring to the silk, cutting two grooves for the elastic to lie in so as to be out of the way of the opposing teeth and less irritating to the tongue.

"The gold wire being made springy and standing off from the teeth is dragged against them by the elastic, but when their movement has commenced the wire regains its normal curve, thus lending additional outward force, and does not uncomfortably protrude the lip, but is farthest away from the side teeth.

"In conclusion, how far does this method fulfill the conditions required?

"It is certainly efficient, because the contraction of an elastic ring is a constant force very different from a piece of compressed wood, whereof the full expansibility is gained in at the most two hours.

"It is more comfortable to wear than a plate which is displaced by the motive power, for in this the position of the wire and plate is constant, the elastic working on the tooth from two fixed points."

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

PRACTICAL RADIOGRAPHY FOR THE ORTHODONTIST*

By Captain Edward H. Skinner, M.R.C., Kansas City, Mo.

GENERAL CONSIDERATIONS

IT would seem that the field of radiography in orthodontics has been quite well covered by many able writers. In fact, it seems superfluous for anyone to stand before such a group of eminent specialists merely to reiterate x-ray facts familiar to all.

At one time it seemed as though the x-ray was to play a minor role in orthodontics—that the x-ray was merely to vividly portray in a tangible manner the presence or absence of certain teeth. This is simplicity itself. One has only to place a film upon one side of the suspicious area and focus an x-ray tube upon the other side toward the film.

But just as orthodontics has stepped forward and beyond the mere straightening of teeth, so we may rightfully expect that the x-ray is capable of helping much more than was at first anticipated.

We have seen the x-ray develop from the locator of bullets and the critic of fractures to a diagnostic factor in many branches of internal medicine. It even becomes a therapeutic guide in the analysis of thoracic and abdominal pathology. The x-ray has swooped down upon general operative dentistry and taken a hold that is warranted by the increased skill which it demands of the dental operator. Formerly the surgeon probed for bullets just as the dentist probed tooth canals. The surgeon failed to locate the bullet and at the same time increased the mischief of infection in his wound. Just so the dentist probed, broached, and worked blindly, only to stop in despair and close up a tooth without adequate attention to the mischief remaining sealed in and about the apices.

The modern surgeon consents to let the innocent x-ray become his probe and locator; and the modern dentist is adding the x-ray machine to his dental equipment. The orthodontist requires the x-ray for more reasons than that it is an excellent locator of hidden problems. He uses it as a critic and guide for the delicate mechanical forces he employs to correct deformities. He uses the x-ray to reassure himself of the innocent damage which his appliances inflict upon the tissues about the harnessed tooth and upon the integrity of the tooth

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 7, 1917.

Since this article was written, the author has been called into service and was therefore unable to prepare the necessary illustrations.—Editor.

itself. What does it profit the orthodontist to correct a deformity if he unconsciously inflicts an apical infection of potential danger to the patient?

Recently we all have seen the mechanical prowesss of American dentistry suffer a certain amount of chagrin and lay itself liable to a charge of gross negligence and wanton disregard of the principles of surgical sepsis. It is well the orthodontists are mindful of the potential possibilities of infection about teeth which are moved from a habitat of choice to one of efficiency. We are all familiar with the psychology of freedom and efficiency. Freedom makes stalwart native strength, while efficiency requires constant supervision or the efficiency will be undermined. Just so the tooth, which is allowed to follow its own decrees of location, will be surrounded by good stout tissues; but as soon as you forcibly, even daintily, alter the location of the tooth you find it necessary to nurture the tissues about and provide ample support for maintaining the new position. We must always fertilize ground which is bearing a strange crop.

Perhaps this philosophic rambling may seem strange, but my idea is to emphasize the fact that the x-ray will serve you well as a source of information regarding the behavior of the tissues about the teeth. When one has familiarized himself with the normal appearances of the bone texture about roots of teeth, he is then able to read the textural changes upon x-ray films of areas where teeth are being shifted. For the x-ray shadows are merely records of density and show the projected histology or pathology. In the interpretation of all x-ray images it must be remembered that we obtain a projection of the textural densities upon emulsions and the analysis of these shadows depends largely upon our knowledge of histologic and pathologic tissue. For instance, caries of a crown just below the visual gum margin is recorded as an area of increased radiability or rarefaction because caries means a loss of the dense enamel which is normally opaque to the x-ray. Again, a granulation charge about the apex of a tooth root means a liquefaction or absence of lime salts now occupied by the granuloma and therefore this periapical area is rarefied, less opaque, and shows no textural lines of normal mandibular bone.

There is a wonderful opportunity for some brilliant literature upon projected mandibular densities as revealed by the x-ray. I venture to show you a set of slides which are reproductions from a monograph by Symington. These show the progressive character of the increase in densities and delineation in texture through childhood and adolescence in a most graphic manner. We must all familiarize ourselves with these shadow values of the projected bony texture upon x-ray emulsions. X-ray films must secure an analytical interpretation or they will be considered to reveal that which they do not reveal. One must not interpret a granuloma because it looks like the granuloma shadow which was seen upon another film. The varying contrast of exposed films forces the analytical interpretation of each case and always in the light of the clinical findings of the individual case.

PRACTICAL RADIOGRAPHIC TECHNIC

There are several points which may be worthy of review for this audience. They are not new. It is only because most of us get into the habit of doing things in the easiest way that we sometimes disregard a better way.

I desire therefore to briefly discuss these points:

1. Identification of films
   (a) by case
   (b) for position.
2. Methods of holding films in position.
3. Charts for exposure position.
4. Visualization of exposure position.
5. Development of films; sticks, clamps.
6. Filing of films (celluloid, glass, envelopes).
7. Viewing of films, illumination boxes, etc.

IDENTIFICATION OF FILMS

The identification of several dental films taken of the same individual is not a difficult situation. When six to ten films of the upper and lower dentures are taken, one may lay out a single set of films after development and arrange upper centrals as opposing the lower centrals. The upper centrals have broader crowns than the lowers. The lower centrals are fairly straight teeth and look like slim pegs while the upper centrals are more bullet-shaped and sometimes appear to have a circular constriction or neck at the alveolar margin. The molars are just as easily identified as there are three roots to upper molars and two roots to lower molars. Frequently the upper third and sometimes the upper second molar, have fused roots and present a conical shaped shadow.

Again, upon films of the upper molars and bicuspids we have shadows of the maxillary sinus, which absolutely identifies a film of the upper jaw. In films of the lower bicuspid area, one sees the mental foramen below the apex of a bicuspid tooth (this is frequently misinterpreted as a granuloma or apical abscess). The inferior dental canal is seen upon films of lower molars and even the inferior margin of the lower jaw is seen upon a film which is placed deeply beside the molar area. To recapitulate:

Films of the upper teeth show:

1. Maxillary sinus.
2. Molars have three roots (excepting third).
3. Upper centrals show broad crowns and conical roots.
4. Median raphe distinctly visible.
5. No foramens or dental canals visible.

Films of the lower teeth show:

1. Molars have only two roots.
2. Mental foramen.
3. Inferior border of lower jaw.
4. No maxillary sinus shadow.
5. Lower centrals are straight and peg shaped.
6. No median raphe discernible.
7. Inferior dental canal.

Where the preceding identification is not sufficient one may make punch marks with a fine sharp point in the film before exposing. The punch mark

is placed near the edge of the film which is at the crown of the tooth and at the left lower border if it is the left upper molar area; at the lower middle part if of the upper centrals; at the lower right margin if of the upper molar, etc. The punch mark can be made with a tenaculum forceps but one of the sharp tenaculums must be broken off so that only one fine point penetrates the paper covering the film, otherwise too large a hole will be made and the film about the hole will be fogged. We have had a small tenaculum forceps fixed by adjusting a flat surface upon one of the tenaculum points.

IDENTIFICATION OF PATIENTS

Where one to ten films of several patients are made every day it becomes an exciting task to prevent confusion in the dark room. Of course, the dentist can identify the case sometimes by the fillings in certain teeth shown upon the film but the charting of the dentures is too much to ask of the roentgen technician. Someone has proposed to label the developing sticks or clips. If one is using the stick or clips manufactured by The Eastman Company, a celluloid marker with the patient's name may be placed in one of the clips and carried through to the final filing of the films.

My method is to make a dark-room list of the films as they are exposed, beginning each morning with No. 1 case and making one punch mark upon the lateral margin of all the films taken in the No. 1 case; two punch marks are made for case No. 2; three for case No. 3, etc. After the fifth or sixth case, one can draw a line across the dark room list and start over again with No. 1, because the previous cases will have been developed, dried and mounted by this time. During the day it may be necessary to use three or four sets of dark room lists. Even with making as many as four to ten films of twenty cases a day, this method has worked successfully. Naturally the films must be worked through rapidly and the day's work cleaned up each day.

HOLDING DENTAL FILMS IN PLACE FOR EXPOSURE

There are innumerable devices upon the market for adjusting and maintaining the films in position for exposure. It goes without saying that neither the roentgenologist nor a regular assistant should hold a film with his own fingers. It is too dangerous. This should be an absolute rule. After trying the many devices, one will realize that the finger or thumb of the patient is the best instrument for maintaining the film in proper apposition. It is fairly easy to have the patient hold the films for all of the upper teeth with the thumb. It seems best to hold the films to the lingual surface of the upper teeth by the patient's thumb of the opposite side (right thumb for films of upper left side and *vice versa*) and it is better to instruct the patient to hold the upper and anterior corner of the film against the hard palate rather than to attempt to hold the film against the teeth. The latter method favors the slipping of the film. However, for lower molars and bicuspids it is well to have an instrument which almost forces the film down low in the mouth so that the roots will show up satisfactorily.

There are several instruments upon the market for this purpose. The first

was introduced about ten years ago (Kny-Scheerer Co.) It has a slot for the film attached to a cork-padded bite-block and the handle is interchangeable at each end of the bite-block so that it can be used for the upper or lower right or left side. Another simpler similiar instrument has recently been placed on the market under the name of the Door Dental film holder (V. Mueller & Co.). A third instrument is the wire film holder designed by Leach, of Chicago, (Victor). This spring wire film holder is so made that the two circles of wire slip between the folds of the No. 1 or No. 2 Eastman films and permit the patient to hold the film in place by the handle. It is interchangeable for right and left sides. Another form is made for anterior teeth. The patient must hold the handle steady. It is not sufficient for the patient to bite the neck of the handle. We shall only mention for the sake of completeness (a) the elaborate set of film holders designed by Ketcham, (b) the cork bite containing the aluminum slip of Rich-Syfert, (c) the mouth balloon of Ciezniske. The aluminum envelope designed by (d) Potts of Spokane is interesting. It requires the large No. 3 Eastman film ($2\frac{1}{4} \times 3$). The patient bites upon the aluminum envelope and the tube focused upon the points attached to the false film. This false film is withdrawn and the true film introduced just before the exposure is made. Stereoscopic films are easily made with this instrument by focusing stereoscopically upon the false film points and then changing films between exposures by hand, the patient's head being fixed rigidly by sandbags attached to a canvas band.

This latter instrument is especially useful in making roentgen records of orthodontic patients. Here one does not require the intimate detail about the roots of the teeth but rather to see a cross section of the teeth and the orthodontic apparatus. It is so easy for the patient to place this apparatus in the mouth and bite down upon it to maintain it in a proper position.

For the orthodontist, an extraoral method of exposure is recommended. The patient is placed upon a table with the affected jaw upon an inclined plane of 25°, with the plate between the jaw and the thick side of the inclined plane at the neck. The tube is focused from below the opposite mastoid process toward the jaw which one wishes to radiograph. This position is attributed at various places in the literature to Haenisch, Quiring and Pfahler. It is possible to obtain interpretable shadows of all the upper and lower molar, bicuspid, and cuspid teeth of one side upon the single plate. By focusing from a point just below the opposite mastoid process toward the mental foramen of the affected side one can sometimes obtain the cuspid teeth also. This method is especially recommended for orthodontics, tumors of the jaws, osteomyelitis, fractures, and impacted third molars where the patient suffers a trismus and can not have a film introduced successfully for an intraoral exposure.

A NEW METHOD FOR MOUNTING DENTAL FILMS

BY W. L. SNIDER, M.D., HOT SPRINGS, ARK.

DENTAL films, after developing and drying, twist and curl up out of shape so that it is difficult to do anything with them. To rectify this condition the following apparatus has been devised to quickly straighten out and leave them in a permanent flat condition.

The parts of the apparatus are shown in Fig. 1 and consist of an ordinary screw clamp that can be purchased in any hardware store and two pieces of

Fig. 1.

Fig. 3.

Fig. 2.

Fig. 4.

galvanized iron cut in the shapes shown in the illustration. The H-shaped piece is 8 inches long and the legs of it are about ½ inch wide. The three small uprights on the crosspiece of the *H* are about ¼ inch wide and ¼ inch high; the space between them is just large enough to hold the films to be flattened. The small rectangular piece of metal is just the size of the films.

Fig. 2 shows the different parts assembled. The legs of the H-shaped piece have been so bent that they will fit over and hold on to an ordinary electric light bulb.

In use the dried films are piled one on top of another in the space bounded by the three short uprights, the rectangular piece of metal is placed over them

and the clamp screwed down with light pressure. The apparatus is hung on a lighted electric light bulb and left there to heat up for 10 or 15 minutes, it is then removed from the bulb and allowed to cool. When cold the clamp is removed and the films will be found perfectly flat.

I find the easiest way to put the films, when they are badly curled, in the apparatus, is to slip them one at a time with the cupped side down under my thumb; the thumb holds each one in place while putting in the next one. This slipping of one film over the other tends to scratch them, therefore, I put one of the black pieces of paper that comes wrapped up with each pair of films between each film.

The film is placed in the mount by weaving it among the projections on the sides of the hole. Start at one end of the film under the first projection, over the second (Fig. 3) and under the third; the end of the film now passes

Fig. 5.

Fig. 6.

over the beveled sides (Fig. 4) and is ready to engage with the projections on the end of the hole.

The middle projection of the end of the hole goes under the film while the two lateral projections go over it. This is accomplished in the manner shown in Fig. 5. Bend the side of the mount backward with the thumb and finger of one hand and push the corner of the film slightly downward with the other thumb until the lateral projection at that corner snaps over the film. Each lateral projection of both ends is snapped over the film in this manner. The film is then mounted (Fig. 6).

This mount is cheaper than any one on the market. It can be manufactured for about one-third the cost of any other.

It can be written on with anything; pen, pencil, or typewriter. Blank space on each side of the film makes convenient place to make notations in regard to pathology shown in the film.

At a recent x-ray meeting it was agreed that the detail of a properly made film shows up better without frosted celluloid back of it.

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EDITORIALS

Missing Teeth in Orthodontic Practice

IT has long been recognized that one of the most troublesome questions in the correction of malocclusion of the teeth is found in the treatment of those cases complicated by missing teeth. Just exactly what to do with these cases and what plan of treatment is best to follow has not been satisfactorily answered for a large number of practitioners. This is proved by the interest that has been shown, whenever the question of missing teeth has been brought up for discussion and by a number of inquiries which have reached our office from various sources in the last few months.

If one will go back through the dental literature a number of years he will find that this question has been discussed in several different ways, and at the present time no satisfactory method has been suggested that can be followed in the treatment of all cases. In fact, one of the greatest troubles that seems to

arise in considering these cases of malocclusion when complicated by missing teeth, is so many practitioners want to follow a fixed rule in all cases rather than to select a treatment which is best suited to the particular case in hand. A few years ago when normal occlusion was considered before anything else, and when it was advocated that any result which did not produce normal occlusion was a failure, there remained for those men but one plan for treating cases of malocclusion complicated by missing teeth. That one plan was the placing of the teeth in normal occlusion and then restoring the missing tooth by an artificial substitute. This plan of procedure was followed for a number of years by a great many men and the difficulty encountered in some instances was in the placing of the teeth in normal occlusion, and in others the placing of the artificial substitute. As a result of this there was more or less friction between orthodontists and crown and bridge men in regard to the manner in which the missing tooth should be replaced by an artificial tooth. As a result of this controversy and as a result of a large number of unsatisfactory artificial restorations, some men began to wonder whether it was always advantageous to open up the space for missing teeth in all cases. As a result of closer study of these conditions it finally developed that there was a large number of factors which should be taken into consideration in dealing with the question of missing teeth. One of these conditions was whether the tooth was congenitally absent or whether it had been extracted. Another important factor was the age of the patient at the time of the treatment of malocclusion. Another thing to be considered was the position of the natural teeth and the necessary tooth movement involved if the space was to be restored, and lastly, after the space has been restored, came the question of the best means of restoring the missing tooth by an artificial substitute. All of these things and probably more have to be taken into consideration.

In deciding what plan of treatment is to be followed in reference to missing teeth, we must take into consideration the occlusion and esthetic results, as we find them. We must consider what the result is to be according to what plan of treatment is followed and what benefit it will be to the occlusion and facial outline. We must remember that any plan we choose will not give an ideal result, for the establishment of an ideal occlusion is impossible in cases complicated by missing teeth, whether we replace the missing tooth with an artificial substitute or follow some plan which gives a compromise occlusion, based upon the masticating efficiency of the teeth. After considering the occlusion and esthetic conditions as we find them and carefully considering the changed conditions as the result of the different plans of treatment, we are ready to consider some of the other factors which may be termed difficulties encountered in the treatment of the case. As we have said, one of the first things is the age of the patient and the condition of the surrounding tissues. It would be possible to institute extensive orthodontic treatment in a child and move teeth a great distance when the surrounding tissues were healthy, while in an adult where the tissues were not healthy we would not attempt such extensive movement. In a young person where the teeth have not been worn by mastication it might be advisable to change molar and premolar relations, mesio-distally, where the abnormal relation has been produced by missing teeth;

while in an older person where use had worn the cusps to occlude in the abnormal position mesio-distally, the best plan would be to leave the molars and premolars where they are.

The question of masticating efficiency as related to esthetics must also be considered as one thing to be recognized in treatment and should be explained to the patient. In some patients, the question of esthetics will overshadow that of masticating efficiency, which will result in one plan being followed, and in other cases masticating efficiency will have the preference in the patient's mind.

If it has been decided that the missing tooth should be replaced by an artificial one the question of prosthetic procedure becomes an important point. In considering this question, we can only do so from the orthodontist's standpoint, and may not agree with prosthetic men. We are aware that the profession will at once be divided upon the question of fixed or removal replacements. In reference to removal replacements, they must be of such a nature as to retain the normal approximal contact of all of the teeth. They must have the proper occlusion and not injure the soft tissue. In reference to fixed replacements of missing teeth, they must be attached at both the mesial and distal sides. It must be an attachment that will mutilate the abutment teeth as little as possible. This means in most cases the use of some form of inlay attachment. The attachment should be made without destroying the pulp of the tooth. The attachment should be made in such a manner as to allow of physiologic tooth movement, under the stress of mastication when possible. As a result of the difficulties encountered in replacing missing teeth, no one plan exactly fulfills all requirements.

In taking up the question of orthodontic cases complicated by missing teeth, we can also consider the cases according to the tooth that is missing, whether it is an incisor, canine, premolar or molar.

In speaking of missing incisors, the condition of the malocclusion must be taken into consideration and the age of the patient before we decide whether it would be the most advantageous thing to open up the space so that an artificial tooth could be placed. If we have a patient with the incisor missing either congenitally or the result of an accident or disease in which all of the other teeth occupy practically a normal position both approximally and occlusally, as a general rule, the only thing to do would be to use an artificial substitute. After the space has been opened and it has been decided to place an artificial substitute, the question of procedure from that point on becomes one of more or less importance. The first question is, How are you going to replace an artificial substitute? To answer this question in a general way we believe that any plan that is followed must be a plan which will support the artificial tooth on both the mesial and distal sides. In other words, no artificial tooth should be placed in an orthodontic case which is not supported by two teeth. In making this statement we recognize the fact that we are going to be criticized because in doing this it will be necessary to mutilate the two approximating teeth. In mutilating these teeth we are aware of the fact that we will be confronted by the question of whether or not we shall remove the pulp. This particular question will be answered very emphatically, both ways, depending on whether

the crown and bridge man is one who believes in "vital" attachments or one who believes in "devitalizing." We recognize the argument on both sides of the question, both from the standpoint of the crown and bridge man and from the standpoint of the orthodontist, as well as the efficiency from the standpoint of the patient; it has seemed to us that the most important thing to consider in orthodontic cases where missing incisors are being replaced is the question of esthetics and the maintaining of the occlusion of the other teeth. The question of strength and masticating efficiency becomes the third feature of consideration. In other words, orthodontic patients, who have artificial teeth in the anterior part of their mouths should be instructed that those teeth *will not stand* a large amount of mastication and must be favored. The reason for this advice is that if the case is favored and they are advised that a large amount of mastication can not be done on those teeth it makes possible an attachment which is better from an esthetic standpoint, although it possesses less strength. Working from the standpoint of esthetics in the maintaining of the occlusion of the remaining teeth, we believe the best plan of attachment is not to "devitalize" the abutment teeth but to place the missing tooth by means of inlays which can be done without endangering the pulp of the natural teeth.

In attaching artificial incisors by means of inlays, the inlays must be made small and placed in such a position as not to endanger the pulp. In a great many cases owing to the close occlusion between the upper and lower incisors some form of iridio-platinum spur, the ends of which are attached to the inlay can be used to strengthen the attachment of the artificial tooth. These inlay attachments, being necessarily made small so as to avoid the pulps of the teeth, do not offer as much strength as do the artificial teeth replaced by means of a post. However, the patient must be cautioned that an artificial tooth is inserted primarily for esthetic reasons and will not stand a large amount of mastication. They must also be told that it is more essential that they have a good appearing artificial tooth, without the possibility of causing discoloration in the attached tooth which may occur if the pulp is removed than it is to have one extremely rigid which does not look so well and which may result in discoloration and disease of the attached teeth.

It is better for the patient to have the artificial tooth reattached or recemented several times a year than it is to run the risk which may come from destroying a pulp. The one principal objection in making attachments for artificial teeth by means of inlays in the anterior portion of the mouth, is that owing to the small amount of tooth surface involved it is very difficult to make an attachment which fulfills the physiologic conditions of mastication. It is very difficult to attach the artificial tooth in such a manner that the abutting tooth can respond under the stress of mastication which is one of the physiologic factors. Even though physiologic tooth movement can not be obtained in the anterior portion of the mouth as satisfactorily as in the case of molars and premolars, we believe the inlay attachment offers better conditions than any plan which has been followed heretofore.

We have seen a number of cases which involved missing maxillary laterals in which we believed a more efficient result from the standpoint of occlusion and mastication and even probably from the standpoint of esthetics could be ob-

tained without opening up the space for the lateral. We refer to those cases which sometimes have been classified according to Angle's plan, as a subdivision of Class II which really are not distoclusion cases, but which are cases in which the maxillary molars, premolars, and canines because of loss of approximal contact, have taken a mesial position in regard to mandibular teeth. In other words, we find the mesio-buccal cusp the maxillary molar occluding between the mandibular first molar and second premolar, with the maxillary first premolar occluding between the mandibular first premolar and canine and the maxillary canine occluding in the position of the maxillary lateral. In order to open up this space for this missing lateral, it would be necessary to move distally all the molars and premolars and canine upon that side. This movement could be accomplished, but it involves a long period of orthodontic procedure which in a patient past the age of twelve would be a very questionable thing to do.

In order to establish anything like an efficient occlusion such as we have in the beginning a bodily movement of all of those teeth would be necessary which, while possible, would involve a long period of time and would result in an occlusion which from a point of masticating efficiency would be no more satisfactory than the one which we had in the beginning. We believe in a large number of those cases a much more efficient occlusion can be obtained and a dental apparatus produced which will be more serviceable to the patient by leaving the maxillary molars and premolars on the abnormal side in the mesial position and correcting whatever other malocclusions may be present. One of the reasons a better occlusion of the molars and premolars from a masticating standpoint can be obtained by leaving them alone is that the cusps have worn to fit in that position. If the patient had never masticated sufficiently to wear the teeth, this plan would not be so advisable. After the malocclusion is corrected, the maxillary canine which is in the place of the lateral can be ground down and made to resemble a lateral as nearly as possible.

We will admit that this plan does not give the most ideal esthetic result, but often gives a much more efficient occlusion and one which is going to be much more serviceable for the patient than would be obtained by the long orthodontic procedure of moving the molars, premolars, and canine distally and then forcing to place an artificial lateral. We have known of several such cases which have been treated with the idea of restoring the space for the missing lateral and they have not been satisfactory results in the end. We would especially recommend this plan of treatment, which may be termed compromise treatment, as being the one indicated in patients in whom the second molars have erupted and where the question of masticating efficiency and permanency in results are considered more important than the ideal molar relation with possible improved facial outline. We are aware of the fact, that the statement has been made that the upper arch should be expanded and the space made for the missing lateral in order that the nasal cavity and sinuses may have their proper development.

However, in answering this argument, you must remember that we have approximately the same amount of expansion of the upper arch by leaving the maxillary molars and premolars in the mesial position and occluding normally buccolingually with the mandibular molars as we would have if we moved the maxillary molars and premolars distally, which movement would in no way increase

the expansion of the maxillary arch in such a manner as to produce a development in the nasal cavity. In other words, in the style of cases which we have described the space if made for the maxillary lateral would not be obtained by an expansion of the maxillary arch but by a distal movement of the molars, premolars, and canine. Therefore, the argument for the development of the maxillary arch loses weight because a distal movement of the molars, premolars, and canine would not produce an expansion of the maxillary arch. Again, besides the difficulty encountered in the distal movement of the first and second molars, premolars, and canine, we have to consider the possible result upon the maxillary third molar which in some cases will produce no trouble, but in other cases, will be so impinged against the root of the second molar that it practically prevents a bodily distal movement of the molar teeth.

When we consider the question of replacing canines which are seldom missing except as the result of accident or disease, we again must take into consideration the conditions present in that particular case. If we had a case of malocclusion in a comparatively young patient in which all of the remaining teeth occupied a normal mesio-distal relation to the occluding teeth, as a general rule, we would say the upper canines should be replaced by an artificial substitute. This artificial substitute should be anchored to both the premolar and lateral, at least the anterior end of the mesial surface of the artificial canine should have some sort of support upon the lateral incisor. This support should be made in such a manner as to maintain normal proximal contact and prevent the lateral incisor from slipping past the artificial canine labially or lingually. We also would suggest that in these cases an inlay be placed in the lateral which would be cemented in place. A cavity or groove should be cut in the inlay for the reception of an abutment or spur from the artificial canine. This would give a support occlusally, bucally and lingually and still allow for a certain amount of movement between the artificial tooth and the canine under the stress of mastication and thereby more nearly approach physiologic conditions. From our observation, we also believe that in the replacement of a missing canine by an artificial substitute, such attachments should be made as would not destroy the pulp of either the premolar or the lateral.

We find another class of cases in which the canine has been missing congenitally and the molars and premolars, on that side have come forward until the premolar occupies the position intended for the canine with the molars and premolars one cusp mesial to normal. In such conditions as that, we believe it would be much better not to open up the space for the missing canine but to leave the occlusion as has been established during the process of development and allow the first premolar to occupy the position of the canine, with all the molars and premolars on that side one cusp mesially. Such conditions as this will give just as good an esthetic result as would be obtained if the canine were in position, for the first premolar has probably erupted in an upright manner and in its forward position the crown and root consequently fills out the corner of the face the same as a normal canine would. The occlusion of the mesial molars and premolars have probably worn in such a manner as to make an efficient occlusion which would be just as good from a masticating standpoint as if they occupied their normal positions.

Another condition, which we sometimes find in missing canines is that in which there is a normal mesio-distal relation of the molars and premolars with the first premolar in the arch from which the canine is missing, in proximal contact with the lateral. In the arch, which contains the full number of teeth we find the premolar region very badly bunched with one of the premolars in linguoversion and the other in buccoversion with probably decided torsiversion of the canine and lateral. In these cases, after the eruption of the second molar, we find the orthodontic treatment would be decidedly shortened by the extraction of one of the premolars from the arch which contains the full number of teeth. In some instances, the extraction of the canine might be advisable provided it was in the lower arch, but in such cases as we have observed, the best masticating results have been possible by the extraction of a premolar. This leaves the same number of teeth in both arches and makes possible an efficient occlusion with the least possible movement of the remaining teeth which from a masticating standpoint is very efficient.

We also find the esthetics of those cases are very good and in patients after the eruption of the second molars past eighteen or nineteen years of age we believe such a compromise treatment is the best thing advisable.

The question of missing premolars, upper or lower, is very much the same and has to be considered in regard to the age of the patient, the extent of the development of the alveolar process or growth of the jaws, and whether the tooth is congenitally absent or has been lost as a result of accident or disease, and the position of the remaining teeth from an occlusal standpoint. In dealing with premolars that are congenitally absent, we have found in our practice the ones most often missing are the mandibular second premolars. Because of this, we believe it is a good plan in the treatment of every case of malocclusion before the time of the eruption of the premolars to have radiograms made to prove whether the premolar is missing or present. Therefore in treating a case of malocclusion in which we find the mandibular second premolar is absent, we believe a more efficient result from the standpoint of serviceable occlusion can be obtained by instituting a plan of treatment, which will move the mandibular molars forward to the width of the premolar, therefore establishing a mesial occlusion of the mandibular molars with the maxillary molars and closing the space in that manner. Cases treated by this plan prior to the eruption of the second molars have shown that the first molars can be moved forward bodily and the second molars in erupting will take the position approximating the first molar. This plan of treatment produces the normal occlusion of the teeth from the first premolar forward and the mandibular molar one cusp mesial. The masticating efficiency, in these cases, is far superior to those in which a missing tooth is supplied and one which eliminates the possibility of trouble by making attachments to vital teeth.

The congenital absence of maxillary premolars before the eruption of the second molar should be handled in the same manner, which would consist in the mesial movement of the maxillary molars to close the space of the missing tooth. In cases of advanced age, after the eruption of the second molars, where premolars have been lost as a result of accident or disease, the treatment in those cases would depend upon the condition of the remaining teeth. If the space

of the missing premolar has been closed by a mesial drifting of the tooth distal to the space, in the majority of cases, it is the most advisable plan to straighten up those teeth and restore their use by an artificial substitute. In cases of patients of advanced age, who because of extraction have lost the masticating efficiency, it is not always desirable to attempt a mesial movement of the molars to close up the space made vacant by the premolars. In these cases, which are the result of mutilation, something must be done to improve the masticating apparatus of the patient. We must decide what is going to give the most serviceable results with the least possible sacrifice to the patient and if that plan is followed, which involves the opening up of the spaces, we then have to use artificial substitutes the same as we would in any other class of case where artificial substitutes are required to improve the function of the teeth. Again, in the replacement of the premolars the same plan must be followed, the replaced tooth must be attached at both ends. Secondly, we believe the best results can be obtained by means of inlay attachments which may be described as one inlay within another or by some form of removable attachment which allows for individual movement of the teeth during mastication.

As a general plan, we would condemn the "devitalization" of both teeth or any plan of attachment which has for its object the production of extreme rigidity which would not allow individual movement between the abutments under the stress of mastication. We would also as a general rule condemn the use of shell crowns as a means of attachment not only because of the rigidity but also because of the great tendency for gingival irritation where shell crowns are used. Another type of case which we have to consider is that in which the premolar has been congenitally absent or has been lost early in the life of the patient. In those cases in which the maxillary and mandibular molars occupy a normal mesio-distal position to each other and the teeth in the arch from which the premolar is missing have approximal contact, the arch is in fairly good shape. The arch which contains the full number of premolars is badly contracted with probably one of the premolars in linguoversion and the other in buccoversion and possibly some torsiversion of the anterior teeth. We also find some of these patients in which the second molars have erupted and the patient is past the age of greatest development.

Therefore, we believe in the majority that a much more serviceable result can be obtained by the extraction of one premolar from the arch which contains the full number to correspond with the missing premolar of the opposite arch. This will then make possible the alignment of the remaining teeth and consequently produce a very good harmony in the size of the arch and a very serviceable occlusion. This result can be obtained in much less time than to open up the space for the artificial tooth and eliminates the necessity of putting in an artificial substitute, as a result of which we believe a better service has been rendered the patient by harmonizing the two arches and producing a serviceable compromise occlusion than would have been obtained by opening up the space and putting in an artificial tooth.

You will therefore notice in dealing with the question of missing premolars, we have advocated three different plans of treatment, all of which are based on conditions outlined in the beginning; namely, the age of the patient, the position

of the remaining teeth and the stage and development of the alveolar process. Each one of these plans have been different and each one gives the most satisfactory results in the particular case outlined.

When we come to the consideration of missing molars we again must be controlled by the age of the patient and the condition of the malocclusion as we find it. We believe in young individuals, in children before the eruption of the second molar where the first molar has been hopelessly diseased and has to be sacrificed, the best plan of treatment is to move the second molar forward during the process of its eruption and make it occupy the space formerly occupied by the first molar. Various cases treated by this plan show that by proper orthodontic procedure maxillary and mandibular second molars can be made to assume the position of the first molars, in an upright manner and so produce a very serviceable occlusion. This plan of treatment also avoids the necessity of wearing a mechanical retaining device to keep the space made vacant by the missing first molar. We even find another class of cases, after the eruption of the second molar and before the eruption of the third, in which we believe it is advisable to bring the second molar forward and close the space made vacant by the first molar. We refer to those cases in which the radiogram reveals the first molar to be in such a hopelessly diseased condition that the question of its loss will only be that of a few years. We believe in such cases it is better to extract the first molar in a patient twelve, thirteen, or fourteen years of age and bring the second molar forward bodily to close up the space made by the loss of the first molar. Upon eruption the third molar will take its position behind the second molar and will generally be a very serviceable tooth. We have observed in these cases where the first molars are lost early, the third molar has always possessed a well-developed crown and become a very serviceable tooth which is probably caused by relieving the pressure and bringing the second molar forward and giving the third molar ample room to develop.

In mutilated cases in adults in which there has been a loss of first molars by extraction and the space has been closed by the drifting of the other teeth, we can only say that each one of those cases will have to be decided upon the conditions present. We very often find the second molar has tipped forward and in straightening up the second molar after it has assumed a normal occlusal plane, we still find that the tooth occupies a position mesial the width of one cusp. In these cases, we do not believe that the best plan of treatment is to move the second molar distally to a normal position, but a more serviceable condition can be obtained with a shorter orthodontic treatment by leaving the tooth fitting mesial in the normal occlusal plane than by attempting to move it distally to its normal position. In opening up the space for missing mandibular first molars, it is always necessary to move the teeth anterior to the space, the canine, premolars and incisors, into the normal position mesio-distally. As a result of this treatment, we only open up space sufficient for a premolar, but all of the teeth anterior to that space occupy normal mesio-distal relation and the mandibular molars, second and third, are set into an upright occlusal position even though one cusp mesial. In opening up spaces for missing maxillary first molars the same plan can be followed in that the posterior molars must

be placed in an upright occlusal position, but it is not absolutely necessary that they be moved distally to their normal positions, for in adult patients this movement will very often result in an absorption of the process as a result of the extreme distance which they are removed. After the second and third molars have been straightened up in a normal occlusal plane and occupy normal bucco-lingual relation, we do not believe that an ideal or normal mesio-distal position very greatly improves the masticating efficiency of those teeth.

In replacing missing molars, the manner of attachment will depend more or less upon other conditions present. However, if the second molar or second premolar is vital, we would prefer some form of attachment which allows them to remain vital. In other words, we would object to the "devitalization" of healthy teeth for the purpose of making an attachment to carry an artificial substitute. It is needless to say that all replaced molars should be attached at both ends in such a manner as to retain the bucco-lingual relation of the approximating teeth. The attachment should be made in such a manner as to allow physiologic movement of the attached teeth.

Again, we would caution all in considering the question of missing teeth in orthodontic practice to remember that no one plan can be followed and that each case must be decided upon its merits which will take into consideration the age of the patient, the condition of the remaining teeth, the degree of development of the alveolar process, and lastly the occlusal efficiency of the plan that is decided upon. Each case must be decided upon its own conditions and a plan that would be advantageous for one patient would not be the best plan for another.

Announcement of the Meeting of the National Dental Association

THE National Dental Association will hold its Twenty-second Annual Meeting in Chicago, August 5-9, 1918. The headquarters will be at the Auditorium and Congress Hotels situated on Michigan Avenue, corner of Congress street. All meetings, clinics and exhibits will be held in these two hotels, which are connected with an underground tunnel.

The important announcement at this time must be the warning *"Reserve your rooms at once. Make reservations by mail direct to the hotel of your choice. Arrangements for parking cars should be made direct to the garage."*

The following is a list of hotels and rates:

AUDITORIUM HOTEL, MICHIGAN BOULEVARD AND CONGRESS STREET

Single room without bath, $1.50 and $2.00 per day.

Single room with bath, $2.50 to $4.00 per day.

Double room without bath, $2.50 and $3.00 per day.

Double room with bath, $4.00, $5.00 and $6.00 per day.

CONGRESS HOTEL AND ANNEX, MICHIGAN AVENUE AND CONGRESS STREET

Room, detached bath (one person), $2.00, $2.50, $3.00 per day.

Room, private bath (one person), $3.00, $3.50, $4.00, $5.00 $6.00 per day.

Room, detached bath (two persons), $3.00, $4.00, $5.00 per day.

Room, private bath (two persons), $5.00, $6.00, $7.00 per day.

Suites: Two connecting rooms, private bath (two persons), $6.00 to $10.00 per day.

Three or four persons, $8.00 to $14.00 per day.

Corner Suites: Parlor, bedroom, and private bath, $10.00 to $50.00 per day.

THE FOLLOWING IS A LIST OF GARAGES AND RATES:

Our rates for storage are $1.00 for the first 24 hours, and 75 cents each additional 24 hours. At these rates cars can be taken out for driving and reparked during the same 24 hour period at same charge.

City Auto Parking Company,
A. V. Jackson, Gen., Mgr.,

Michigan Ave, and Lake Street,
Chicago, Ill.

We are prepared to take care of thirty or forty cars during your convention, at a special rate of 75 cents per day, provided they notify us of their identity as a member of your Association.

Down Town Garage,
A. J. Bemmer, Mgr.,

Michigan Blvd. and Eighth St.

One thousand cars can be parked in Grant Park (on the Lake Front) free. The City of Chicago furnishes policemen to watch these cars.

—J. P. Buckley,
Chairman Publicity Committee.

GENERAL CLINIC

Arrangements are sufficiently advanced to promise the members of the Association that the General Clinic will be one of the great features of the 1918 meeting.

In conference with officers of the National Dental Association, the Committee in charge of the General Clinic carefully considered the nature of the clinic to be presented this year. After trying for the past few years new features in conducting the Clinic Program, it is the belief that a greater number will be served and benefited by holding a General Clinic, grouped into Sections:—namely—Operative, Prosthetic, Crown and Bridge Work, Orthodontia and Prophylaxis.

To make it national in character, the president, of the different state societies, was requested to appoint two Clinicians and two associates from his state society.

Up to date, thirty-nine state societies are represented and the remaining nine will be represented before the publishing of the official program.

Far away Alaska is sending two and two associates, and to make the clinic more than national, in fact an allied affair, the Canadian Dental Association has promised ten of the best clinicians in the Dominion. In addition, there will be a few unit clinicians who will demonstrate principles that require more than two men.

It is safe to say that this clinic will be unique in the sense that every man on the program will either be present or be represented by his associate.

—Don M. Gallie, Chairman, General Clinic.

GREENE VARDIMAN BLACK MEMORIAL.

A Memorial from The National Dental Association. To be Dedicated at the 60th Anniversary Meeting to be held in Chicago, August 5-9, 1918.

The International Journal of Orthodontia

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ORIGINAL ARTICLES

MULTIPLE FRACTURE OF THE MANDIBLE, CAUSING A MARKED DENTOFACIAL DEFORMITY, THE RESULT OF A DYNAMITE EXPLOSION—METHOD OF TREATMENT: SURGICAL, ORTHODONTIC, AND PROSTHETIC

BY M. N. FEDERSPIEL, B.Sc., D.D.S., M.D.
Professor of Oral Surgery, Marquette University Dental School, Milwaukee, Wis.

MY REASON for reporting this interesting case is to show what can be accomplished in the treating of a multiple fracture with loss of tissue, leaving a marked displacement of the mandible. On March 8 I was called to Mt. Sinai Hospital to treat a fractured mandible of Mr. K., age twenty-seven years.

HISTORY

A premature explosion while blasting rocks shattered the patient's arm and produced a multiple fracture of the mandible. I found a fracture of the neck of the condyle on the left side with the condyle torn out of its glenoid fossa and lying in front of the eminentia articularis, a compound fracture between the left cuspid and lateral and another fracture between the right second bicuspid and first molar.

On account of the patient being in a precarious condition, it was deemed advisable not to attempt fitting any fixed appliance to his teeth in order to immobilize the broken jaw, until he was strong enough to sit up. However, a temporary splint was fitted.

In the meantime, Dr. Charles Lemon amputated his arm. After five days had passed and the patient was stronger and recovering from the shock of the explosion and the operation on his arm, I proceeded to prepare him for treatment of the injured mandible.

Fig 1.

Fig. 2.

Fig. 5.

Fig. 3.

Fig. 4.

At this time, an infection had developed at the fractured points with pus flowing freely. The left lower lateral and left central were knocked out at the time of the explosion and from the sockets of the lost teeth pus was oozing. A subperiosteal abscess had developed below the chin. Upon passing a probe through either one of the sockets it would pass through the bone into the subperiosteal abscess.

The compound fracture on the right side of the mandible, which was between the second bicuspid and the remaining diseased root of the first molar, was also suppurating into the mouth, and the gland below it was very much enlarged. On account of the neck of the left condyle being fractured and the condyle torn from the socket, rotated and lying in front of the eminentia articularis, the jaw shifted backwards causing the facial lines to be very much distorted. In consultation with Lemon it was deemed advisable to remove the condyle surgically after immobilizing the two compound fractures of the mandible and later correct the occlusion by orthodontic treatments.

Bands of nickel silver were fitted to the first and second molars on each side. A tube, gauge 16, was soldered to the bands and cemented in place. Plain bands with small hooks attached were cemented on the teeth anterior to the molars. The next day, under local anesthesia, I curetted the diseased bone at the fractured points, opened up the subperiosteal abscess, packed the wound with iodoform gauze, and extracted the diseased roots of the lower right first molar. An alignment wire, gauge 16, was then slipped into the tubing attached to the molar bands, the wire being shaped so it rested neatly on the labial surfaces of the teeth. The fractured parts were then brought together and the teeth firmly ligated to the alignment wire with bronze wire, gauge 28.

This simple appliance firmly immobilized the broken bone, the jaw was then bandaged and treated daily by cleansing the teeth and changing the gauze. After four weeks the patient was ready to have the condyle removed. This was done under ether anesthesia by Dr. Charles Lemon (Fig. 1). The condyle was found lying in front of the eminentia articularis and rotated. It was freed from the soft tissues and the wound closed. The wound healed without any complication. Four weeks later he left the hospital. By this time the mandible had united at the fractured points. Due to the loss of the lower left central and lateral and the necrosed bone in that region and the loss of the left condyle, the mandible was contracted and shifted to one side. This condition produced a marked distortion of the facial lines (Fig. 2).

On April 22 he was put under orthodontic treatment. The right second molar and second and first bicuspids and cuspid were slowly moved buccally, the right lateral brought forward and distally so that a space was obtained between the right central and lateral of sufficient size to permit an artificial tooth to be bridged in. Under this form of treatment the facial lines were brought to a more normal position (Figs. 3 and 4).

The patient was now ready for bridge work and this was done by my associate, Dr. A. C. Rohde.

Under the above form of treatment the facial lines were corrected and the occlusal lines improved (Fig. 5).

THE DEVELOPMENT OF OCCLUSION*

By Alfred P. Rogers, D.D.S., Boston, Mass.

YOUR committee has provided for your winter's study a series of lectures designed to illustrate, first, the human mouth and its surrounding tissues in a state of health; second, its various phases of abnormal development or disease; third, its restoration or development to the normal.

In order to present these subjects in the best way, the lectures have been arranged in a sequence, which, I trust, when fully presented will yield a wealth of instruction, resulting not only in a valuable addition to our knowledge, but proving also a stimulation to greater effort and more numerous successes. Two of these papers have already been read to you by men well qualified by study and experience. Whatever in their papers may have a bearing upon the subject matter of our present study you will readily recognize and no doubt apply.

You will understand, I am sure, that in treating the subject, "The Development of Occlusion," it will be impossible for me to begin at the beginning and carry you through all that the subject might call for in its complete treatment.

My efforts for you must consist of a more or less incomplete account of my own experiences in the important matter of corrective treatment, and its retention, *particularly during the important period of abnormal variations of development.* From the nature of our study, interest can not be confined to the teeth alone, but must broaden until it embraces those surrounding parts which will be recognized as of vital importance, not only to the successful establishment of occlusion, but also to its successful maintenance.

Before I take up with you any consideration of the practical aspect of orthodontia it will be necessary for us to endeavor to obtain a clear conception of the present scope of the science.

No one of you who has interested himself in orthodontia many years can fail to be impressed with its growth in its different directions. It would be indeed interesting to review these various stages of progress, but its details are, I assume, quite familiar to most of you, and I shall, therefore, pass over them with slight reference. However, in order that we may all start with a common viewpoint, I shall endeavor to define the various subdivisions of our science and lightly trace their connections.

It is true of orthodontia, as it is true of medicine, that the history of its early practice shows that it was conducted in an entirely empirical manner. Gradually the methods of empiricism were tested and sifted through the meshes of scientific thought until there was established the basis of the science of orthodontia. We understand the importance of these early stages when we become mindful of the fact that empiricism is the origin of much of our knowledge. It is simply that we learn from experience, for this great teacher constituted the foundation of practice for our predecessors. Their operative procedures were established solely upon their accumulated experience. In those early days,

*Read before the First District Dental Society, S. N. Y., Dec. 3, 1917. Reprinted by special permission from the Journal of the Allied Dental Societies, March, 1918.

methods of art as applied to orthodontia were crude and quite inefficient. The systematic application of knowledge and skill in effecting wished for results left much to be desired before it could be defined as science, or recognized as art, but, as the methods of empiricism became more thoroughly understood, science began to appear in our theories and practices. Knowledge became systematized. Particularly is this true in reference to their discovery of the underlying truths, such as the "laws of occlusion," and the resulting first classification. Later in its development came the employment of systematic knowledge as applied to physical, mechanical and mental sciences.

You can readily understand then how each of these attributes—empirical practice, art and the collateral sciences, became merged in such a way as to form the real foundation for what is now regarded as a true and useful science. Some still fail to recognize this interdependence, and are apt, even yet, to lay undue stress on the importance of one subject over the other. For instance, the scientific mind, embracing as it does the cold and inflexible methods of science, is sometimes unmindful of the aid furnished it through the agency of art or the methods of empiricism. The craftsman fails, at times, in his recognition of these important scientific principles which are recognized as essential. Some minds fail to recognize either science or art. Their efforts are recognized by the grossest misjudgments and the crudest attempts. Others do not yet recognize that psychology has an important part to play in the management of children during the correction of malocclusion, and many also fail to recognize the value of scientific exercises of the various muscle groups. It is not good judgment, then, for anyone to proceed upon the practice of orthodontia unless he is willing to give the proper amount of attention to the consideration of all of these.

By no amunt of study can the man who is destitute of the instinct of the artist acquire that delicate manual skill that is necessary for accomplishment. Neither is it possible for the one destitute of knowledge of practical psychology to deal successfully with the many harassing problems of harmful habits in the child. The man who is destitute of the teachings of the purely scientific aspects of our work, is as truly at a loss as the untutored in any other field. If anyone chooses to ignore these basic principles in the practice of orthodontia, he is, at once, at a loss upon what to base his judgments, if indeed he proceeds at all upon a successful course in the treatment of any given case.

STANDARDS AND PRINCIPLES

In order to attain progress in almost any undertaking, speaking in a practical sense, it is of the utmost importance that sufficient attention be given to seeking and finding standards and principles. These important elements are established and formulated largely as a result of study and experience. In seeking and finding them one lays the foundation for future usefulness and success.

We are fortunate in having found a standard that is stable. Its fundamental qualities are the same in all races of men. It is true that in many instances our standard is hard to attain, but even so it is to be the constant goal for all our endeavors. Often the attainment of our standard of occlusion is made difficult because the surrounding tissues of the mouth and face have either some acquired

or inherent abnormality in form or action. Sometimes there is an over intensity and sometimes an undue laxness in some particular group or groups of the facial muscles. The muscular balance is often so interfered with that it becomes a serious problem and one that we have not yet fully understood or mastered. Our lack of knowledge in this particular accounts for a large percentage of our failures. The standard (Fig. 1) that nature has placed before us, is faultless in its harmonious development.

What conclusion must we form from such a guide as this? Is there anyone who is willing to undertake the correction of malocclusion, without first recognizing this standard, and without preparing himself in every possible way to secure ability in his work? What does this beautiful picture reveal? Is it wise or profitable in any given case of malocclusion for us to direct our at-

Fig. 1.

tention solely to the teeth? Is there not a standard of development represented here other than that of the teeth? Are they to be framed with indifference? Shall we not seek also a standard of bone development and muscle development? Are these not essential to the full development and maintenance of occlusion?

PLAN OF TREATMENT

I know that you believe with me that the plans that we are laying must be traced in such a way that *the teeth, the surrounding bony tissue, the muscular tissue and function* be rendered *normal* in the *best, easiest and quickest way* that our knowledge can devise.

It is, therefore, our duty to study not alone occlusion, but the health and normality of all these surrounding tissues. One of our first duties must be to

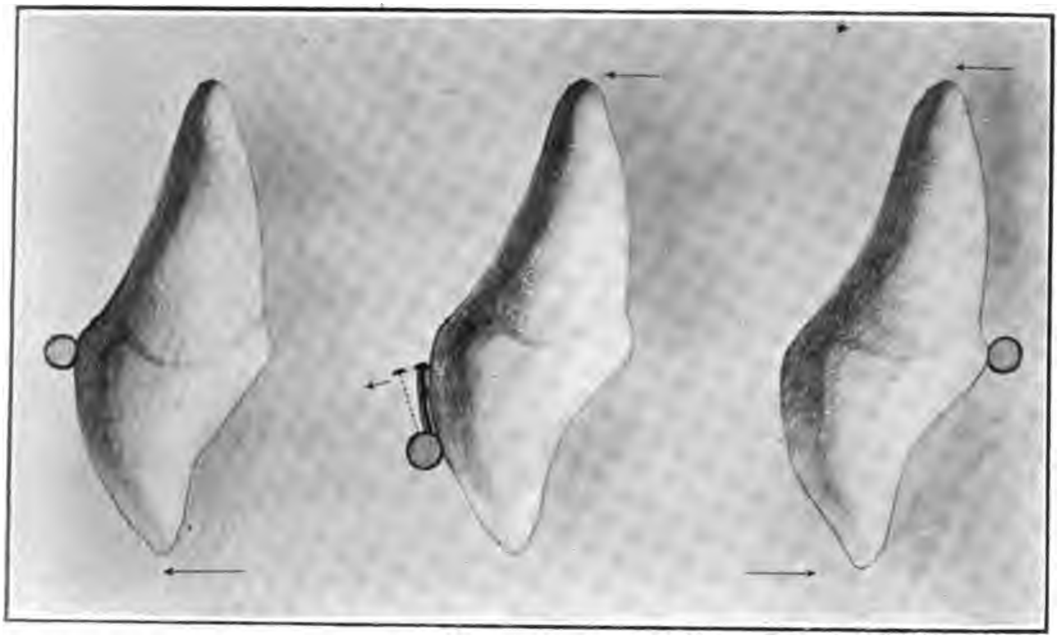

Fig. 2.

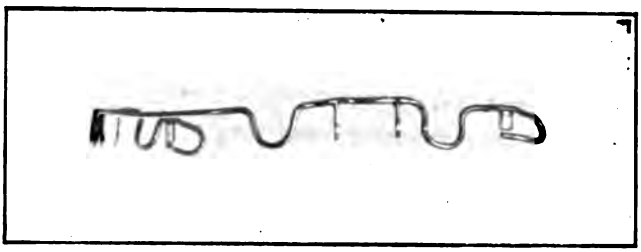

Fig. 3.

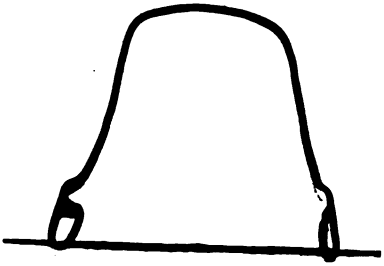

Fig. 4.

Fig. 5.

develop the tissue which is to receive the permanent teeth upon their eruption, commencing at a comparatively early age. *Whatever mechanical stimulation we choose to employ, we must follow it with the development of the function of mastication through muscular development. We must encourage also the development of the respiratory function through adequate and proper exercises. In each case applying methods most suitable to the character of the maldevelopment.*

PRINCIPLES OF CONSTRUCTION OF APPLIANCES

Before we take up the consideration of the treatment of the various cases that I have for your study, let us review some of the important principles involved in the construction of appliances. An orthodontist in his construction of, and in the application of appliances should be most exact in all that he does. His motives should be clearly defined. *He should not forget that he is responsible for the health of the tissues immediately surrounding the teeth, as well as the health of the teeth themselves.* Hastily gotten up appliances, ready-to-wear appliances which are oftentimes inadequate even when carefully adjusted, are to be avoided whenever possible. *The construction and application should be made so carefully that the patient is given the minimum of discomfort not only during the application, but during the long period of their use.* The operator must feel sure that in making this application he not only is causing no harm to the tissue, but is actually, in many cases, affording means of protection of tooth surface through those inevitably careless years of childhood.

The principles that underlie normal development and normal changes of the tooth position must not be ignored or omitted from the plans of construction, or he will in some instances interfere very seriously with the normal processes of development. This principle applies more particularly to the application of appliances to mixed dentures, and must in no instance be forgotten when efforts are being made during this period of transition.

The most valuable appliances are those which interfere least with the normal tendencies of development, and in their construction and adaptation are freest from interference with muscular activities and habit forming possibilities. When it is found necessary to interfere with any normal function, whether it be of the tongue, lips, or cheeks, some form of compensation must be provided. Possibly an illustration here will help us to grasp my meaning to better purpose. The drawing represented in Fig. 2 indicates the direction of the movement for each of the three appliances: Labial wire, pin and tube and lingual wire. It will be seen that with the use of the lingual wire there is greater opportunity for muscular influence in its relation to the individual tooth movement. The expansion arch, which for so long a time was our mainstay is in my opinion, in the light of recent years of experience, a more or less troublesome appliance; especially in regard to its effect upon the normal action of the lips and cheeks, and most noticeably so when it is poorly adjusted as is most often the case. It will be seen that this application, even when neatly accomplished, interferes and forms a barrier between the lips, cheeks and teeth so that their normal function is seriously interrupted.

It has not the virtue of being provided with a compensatory force such as may be found, for instance, with the pin and tube appliance (Fig. 3). Unfortunately, the pin and tube appliance in its most useful form is difficult for many to construct. Its various forces, compensations and reactions are so imperfectly understood, that for many, its successful use seems difficult. The most generally satisfactory appliance that I have found, especially in the treatment of many young cases, is the lingual wire (Fig. 4) which, when properly understood, applied and manipulated, forms an almost ideal agent for painless development. With this form of appliance the lip and cheek functions are not interfered with in the least. *Its employment gives the greatest encouragement and opportunity for the valuable assistance of properly prescribed exercises.* Its interference with the functions of the tongue is very slight, if it is properly ad-

Fig. 6.

justed, and the individual teeth are free to develop normally with the exception of the molars. But it has its advantage even here, as its attachments afford a direct means for the control of the molars (Fig. 5), and is especially valuable when rotation is called for. It is good practice when practical, to remove this form of appliance during the period of molar drift, or else to apply some compensating force such as may be given by weak intermaxillary elastics. In some cases it is possible to stimulate development of the upper arch by producing a slow progressive development of the lower, by use of the lingual wire, causing adjustment of the upper by a system of exercises designed to stimulate the upper.

It is my purpose tonight to carry you rapidly through stages of treatment from the abnormal to normal in the deciduous dentures. From there through the period of transition to the attainment of the normal in the permanent dentures, touching lightly on the principles involved in the development, and its most efficient means of retention.

Fig. 7.

Fig. 8.

Fig. 9.

STUDY OF CASES FROM PRACTICE

My first picture (Fig. 6) in this series shows the abnormal deciduous denture of a child of six. You will notice it is a class two case with the period of the normal interdental development past, without the appearance of the normal interdental spaces. The distal position of the mandible is due only to the interference caused by a restricted upper arch which has hampered the pterygoid muscles in their efforts to adjust the mandible to its normal position. The right of this picture illustrates the normal development of another child of six years of age. It is a good example of perfect bone development and normal mandibular placement.

Our next picture (Fig. 7) illustrates a child of five with the same form of malocclusion which we have just studied, and which has been successfully corrected by careful and slow development of both arches. The upper, by means of a delicate pin and tube appliance; the lower, by means of a lingual wire. The mandible readily took its normal position when the treatment had pro-

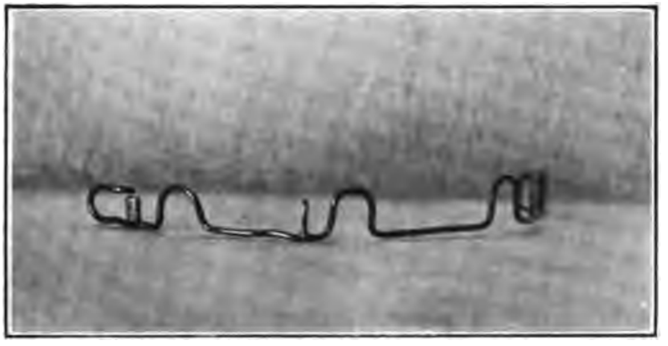

Fig. 10.

gressed far enough to remove the interference. Figures 8 and 9 illustrate the occlusal views before and after development. Those of you who are acquainted with the normal deciduous arch will readily recognize the normal curve which has thus been produced.

The next (Fig. 10) illustrates the appliances used in this development, that of the junior pin and tube appliance and lingual wire. These forms of appliances I wish you to carry in your minds during the remainder of our study of cases before and during treatment. These appliances, with modifications, were used in all cases which will be described until we reach the full eruption.

The next case (Fig. 11) in many respects is similar to the one just shown, except that there did not exist in this malocclusion of the deciduous teeth sufficient interference to cause distal position of the mandible. One of the remarkable features of this case is that the child in every respect presented the characteristics of being under six years of age, although she had passed the age of seven and a half years before the first cast was made. Another feature which I wish you to notice is that the deep overbite has been readily corrected during the process of developing both arches to their normal shape and size. The

Fig. 11.

Fig. 12.

Fig. 13.

figure on the right represents the same case in its normal development, corresponding to the physical development of the child. Lingual wires and exercises are the remaining elements of treatment, except as treatment might be required to control the individual teeth during their eruption.

Fig. 12 is another case of special interest, as it shows the curious position of the mandible, presenting the unilateral, buccal placement of the lower, the

Fig. 14.

Fig. 15.

unilateral, lingual development of the upper being increased by the action of the inclined planes. The narrow arch made it impossible for this child to masticate with comfort. The movable mandible was, therefore, shifted for comfort's sake. The only treatment required in this case was the application of the lingual wire, and its progressive manipulation until the result seen on the right was obtained. In this instance satisfactory development of the lower arch took place without the application of an appliance. Permanent centrals

may be seen erupted in the upper with ample room on the left and right for the eruption of the lateral incisors.

The next illustration (Fig. 13) shows the occlusal view of the upper arch, and in my judgment shows a correct and harmonious arch development.

I shall now show a case (Fig. 14) similar in its nature to the one just seen—having the same characteristics of the lateral position of the mandible

Fig. 16.

Fig. 17.

caused by interference. It is my purpose with this one to carry you over a lengthy period of the development, to show the contrast between the early deciduous and the almost completed permanent denture. The various stages of treatment through which this case passed during the transitionary period, were interesting, but can not be dealt with in this paper in detail. It is sufficient for me to show you the satisfactory arrangement of the permanent teeth, and call your attention to the fact that no further efforts are required except

those of nature in placing the upper left cuspid and lower first bicuspid in normal contact. Exercises which will be described are indicated and practised during closing months of active treatment of this case. It will be interesting for you to know that this development was attained by the application and use of the lingual wire alone.

The next case (Fig. 15) is a sister of the one I have just shown, and its history may be briefly told. The normal development of the arch was obtained by the use of junior pin and tube appliance. The child was under treatment for two winters, and is now under observation during the so far satisfactory and normal eruption of the permanent teeth. The incisors have all appeared, as shown in figure on the right, and no further treatment will be necessary unless individual teeth become misplaced during their eruption.

The next case (Fig. 16) was similarly treated. The appliances are all

Fig. 18.

removed now excepting the lingual wire on the lower. The first biscuspid and cuspids are seen in process of eruption on the right.

Fig. 17 is of a child eight years of age, showing its insufficient development of the arches for the accomodation of both the upper and lower incisors. The pin and tube appliance was used with satisfaction on the upper, and the lingual wire accomplished the normal development on the lower. The child is now progressing normally without aid of mechanical interference.

I am glad to show you the development indicated in Figure 18. The child was placed under treatment at six and a half years of age. It will be noticed that there was room on the anterior segment of the upper arch for development of the central incisors only. On the lower the lateral incisors had erupted at this period, but were in marked lingual position. The case was treated in the manner described in foregoing cases. On the right is presented a completed permanent denture at thirteen years of age. You will notice the satisfactory

bone development and arrangement of the teeth which do not carry with them evidences of orthodontic interference.

The muscular development in this child was satisfactory. She grew, during the process of treatment, into a robust, athletic girl. In the matter of development, utility and beauty of contour, this case, as seen in the picture,

Fig. 19.

Fig. 20.

presents a most satisfactory and inspiring conclusion to the years of treatment.

The type of case here presented (Fig. 19) was one of unusual difficulty. Treatment was commenced the latter part of her eighth year. The model on the right was taken after completion of work, and many months after the removal of all appliances. The pin and tube appliance on the upper arch, lingual wire on lower, with some attachments for accommodation of intermaxillary

elastics, were used. It was difficult in this patient to produce sufficient bone development on the upper arch; in fact, the whole maxilla seemed to be deficient on bone growth, and most careful stimulation failed to produce as satisfactory bone development as it is possible to obtain in the matter of occlusion.

Fig. 20 is of a child eight and a half years of age, and like one of the preceding illustrations it represents tardy development. The child was small of stature and mentally active. The junior pin and tube appliance was adjusted to both the upper and lower arches. Figure on the right shows the marked bone

Fig. 21.

Fig. 22.

development and normal eruption of the incisors. When this point was reached the junior pin and tube appliances were replaced by lingual wires. The next, Figure 21, shows the occlusal surface of the lower. You can readily see the work accomplished without the employment of ligatures, or anything but the simplest of appliances. The next slide (Fig. 22) shows the occlusal surface of the upper. The case has now progressed for several years in a perfectly normal direction, and will probably need little or no corrective treatment other than to see that the muscular tone is maintained.

All the illustrations that we have just been reviewing show malocclusions that lead to greater inharmony in later years. Insufficient growth of the bony framework is the obvious cause.

It will suffice, at this time, to recognize that this condition exists, that it can be corrected, and by what means corrections can be effected in the best and easiest way.

APPLICATION OF EXERCISES

It has long been taught and generally accepted, that after the teeth have been placed in their normal positions of occlusion, and maintained for a more or less lengthy period, retention is assured as far as that is possible. This is far from being the truth, because as already stated, unless the surrounding soft tissues are equally normal in development and action the bony structure supporting the teeth will be influenced in some undesirable direction. The muscles of the face must perform their proper function, and in order to do this they must be strengthened. Strong muscles perform their function without fatigue, and accomplish an unusual amount of work without a great deal of mental effort. It is important also that the posture of the child suffering from malocclusion be improved when needed. This is essential in more particulars than one and I am firmly of the belief that we need proper physical balance in all parts of the body to attain and maintain most desirable results. Posture has important bearing on the position of the mandible, and is of immense importance to general health and vigor. My plea for judicious exercises of the muscles of the face is, therefore, founded primarily upon common sense. By disuse, the muscles of the legs fall below their normal in strength until we are disinclined to use them, and after long disuse we find they will not support even the weight of the body. Yet these muscles are capable of being strengthened to such a degree that they are capable of supporting several times the weight of the body, and are even capable of performing extraordinary feats of strength. They do not shirk at the ordinary duties that are placed upon them when they are strong, but perform them with comfort and efficiency. It is just as true with the muscles of the face as with other groups of muscles. No group has received less attention regarding their proper development than the facial muscles. They have been before us so constantly, and are so intimately connected with the very essentials of our work that it seems strange to me that we have not investigated the means for their development before. It is very true that some of us have thought and expressed ourselves as believing that disuse is largely responsible for malocclusion, but we have been at a loss how to remedy this weakness. Drs. H. K. Hatfield and A. LeRoy Johnson (*Dental Cosmos,* June, 1917) after a series of investigations, have found that the muscular strength of a child suffering from malocclusion is below that found in the normal child.

I have reached the conclusion that the mouth will not perform its full duty until these muscles have been strengthened, and the teeth are in such good occlusion that it requires little or no conscious effort for the masticatory

muscles and teeth to perform any task within their function that may be given them. In order to create in you a sense of the possibilities in this direction, we are going to make a brief study of the principal groups of muscles, after which I shall outline a few of the important exercises which I have found valuable in my work.

Fig. 23.

At the outset let me say that any system of exercises, in its application for the purpose of development of dental arches and facial muscles, must be carefully thought out and adapted to the exact requirements of the case under treatment. The masseter exercises, for instance, should not be applied to a case of malocclusion representing Class II until the interference has been re-

moved, or in other words until the arches have been developed to nearly their normal shape and size by mechanical stimulation, nor should the pterygoid exercises be expected to yield satisfactory results until interference has been removed so that the mandible will have some encouragement to settle into its normal position.

STUDY OF MUSCLE GROUPS

In our brief study of the various muscle groups we shall take time only to note their attachments and comprehend their principal functions. This will

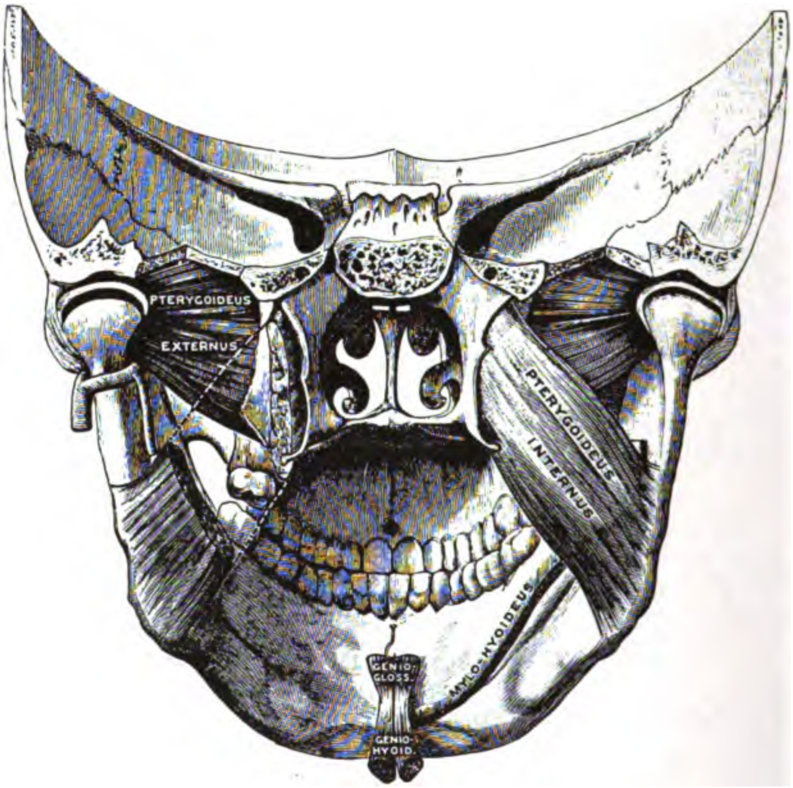

Fig. 24.

be sufficient, I hope, to make us realize quite fully the value of the suggestions relative to exercises, which I am to give.

The study of the smaller groups of muscles, although much may be said regarding their importance, will have to be postponed until some future opportunity. Their consideration would naturally come under the heading of "Facial Habits and Muscular Balance."

I have already reminded you that posture has an important bearing upon the muscular groups of the face, as well as upon the position of the mandible. Of course, we understand that correct posture (Fig. 23) has primarily its beneficent effect on the general health of the child. Whatever tends to place

the child in a more vigorous and healthy state aids the orthodontist in his work. Children who are suspected of being in need of orthopedic treatment should be recommended to consult the orthopedist for corrective gymnastics. It will not be necessary for me to discuss this matter further, although there is much I should like to say upon this subject. We will turn, at once, to the consideration of the principal muscle groups in which we are concerned, and outline briefly the exercises adapted to each.

PTERYGOID

The first group (Fig. 24) I shall select for consideration is the pterygoid group. This figure gives us a clear view of the points of attachment of these important muscles. It will be sufficient, for our present study, to note the

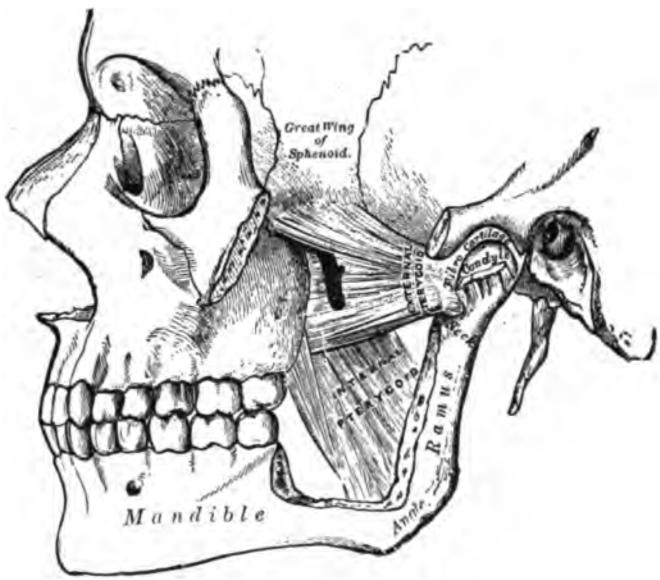

Fig. 25.

relation of the pterygoid fossa and the head of the condyle, and also of the angle of the ramus—the points between which these muscles are stretched.

This illustration (Fig. 25—Gray's Anatomy) shows in a clear manner the direction taken by these important muscles. They represent the invaluable intermaxillary elastics of nature, which, when properly strengthened by exercise during the process of development of the arches, soon offer us a guarantee of unusual merit for the permanence of our treatment.

The following photograph (Fig. 26) represents a subject much in need of the exercise of these muscles, and is one in which marked improvement has been noticed, as a result of faithful practice. The practice of these exercises is simple, and consists in the act of throwing the mandible straight forward as far as possible, repeating the movement until the muscle group shows slight fatigue. The exercise is practised several times during the day at stated intervals. It is especially valuable in Class II cases, and should be commenced

a short time before the dental interference has been removed, or when the upper arch has been so changed as to permit the mandible to assume a nearly natural position.

MASSETER—BUCCINATOR—PLATYSMA

Figure 27 (Gray's Anatomy) reminds us of the attachment of these and various other groups of muscles. I wish you to note in particular the attachment of the masseter, buccinator and platysma myoides. The exercises of this

Fig. 26.

group of muscles are valuable during the period when the arches are nearing their normal in size and relation, or in any case when the harmony of the arches is such as to give opportunity for development through exercises. The exercise consists of first placing the teeth in their best possible occlusion, and with the mandible held immovable a series of contractions and relaxations of the masseter and temporal muscles are practised until these groups show slight fatigue. These exercises, like the pterygoid exercise, are practised at stated intervals during the day, but are increased each day until the patient is able to do them many times without fatigue. Results in many cases will furnish most satisfactory aid to the orthodontist.

For a more comprehensive idea and study of the muscle groups, the reader is referred to the later editions of Gray's Anatomy. Study should be made of separate groups with a view to studying the separate functions and tracing their interrelation. The study of the platysma myoides and its actions will be found particularly interesting.

Fig. 28 gives us the result of these exercises in closing the open bite, after a few weeks of practice by a child nine years of age.

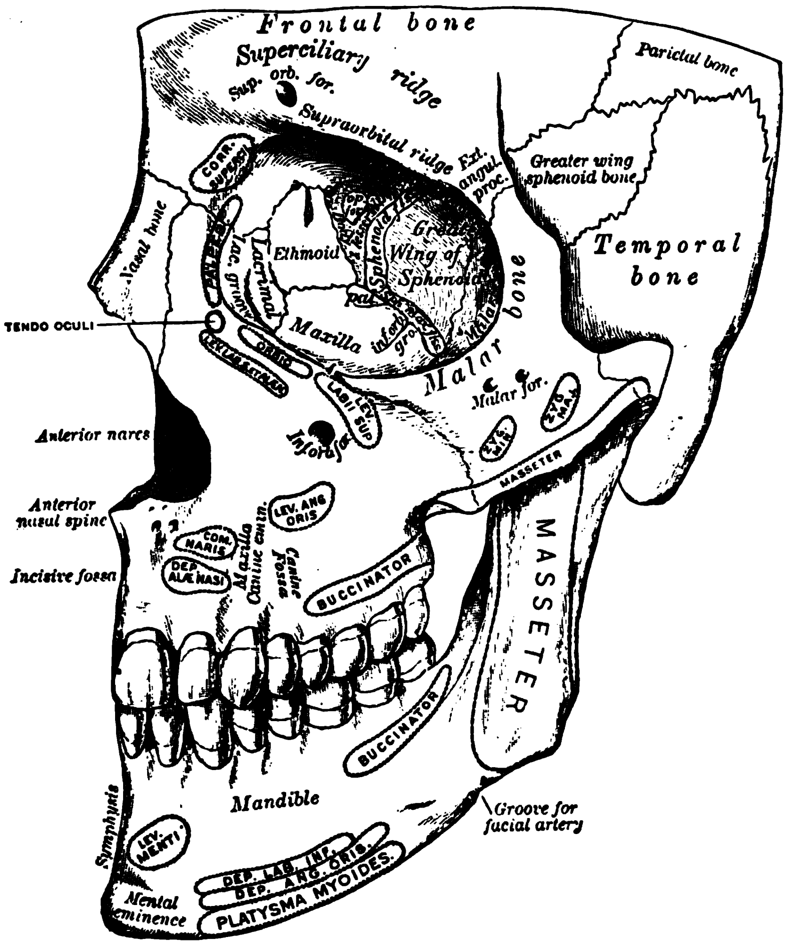

Fig. 27.

The stretching of the platysma muscles is one that must not be overlooked, especially in cases of Class II. The exercises for its benefit are found in combination with the general posture (Fig. 23) exercise, and is here illustrated. The child is directed to look directly above to the zenith, and then accentuating the position by carrying the point of the chin as far above as possible.

It may be claimed by some that little can be accomplished through exercises, because of the operator's inability to secure the faithful cooperation of the patient, but let me say that the art in this lies in making the children ac-

tually want to do the work recommended. Much better results can be obtained in this way than by simply telling them to do it. I have found in my experience, that once the child actually realizes the value to be derived that he is quite anxious to cooperate. Those who can not be so influenced must forego the blessing, but we must be sure the fault does not lie with ourselves.

We must go to primitive man for many physical ideals. He furnishes us with our standard of occlusion and we must not forget that he also furnishes us with other standards of physical development. As a people we have forgotten the importance of the physical, and in our mad efforts to develop the brain, we have neglected all the rest of the wonderful human machine. If we are to succeed in the strenuous battle to come, we must strive in every possible way to develop bodily function to the splendid standard of the perfect man. If we fail in this duty our life shall perish from the earth, and the works of our brain shall be for naught. The dentist in his various specialties is not without

Fig. 28.

opportunity to further the cause of physical fitness, and we will do well if we gain the proper conception of the importance and scope of the field that stretches before us.

PSYCHOLOGIC CONSIDERATIONS

The successful practice of orthodontia depends not only upon the treatment of teeth and bone and muscles and the skilful manipulation of appliances, but upon the psychologic knowledge of the operator and the mental condition of the patient. In the whole wide range of corrective treatment there is no department that so requires the cooperation of the patient. This is primarily true because of the length of time required for treatment, and because the success is not dependent upon the more or less certain action of drugs when the patient is under close observation of the practitioner, but upon the development of somatic tissues over a considerable period of time when the patient would be under regular but not constant supervision. This means that for weeks

or months at a time the results depend upon the fidelity of the patient to carry out important instructions, and the intelligent cooperation of the patient to see that no injurious habits are formed or harmful developments take place without being reported. The general treatment then is mental as well as physical and neglect of this phase is the cause of many failures.

If this is true in general it is much more true in detailed treatment. The patients are all children or adolescents, and it is a well-known fact that children are open to suggestions. *This suggestibility is often detrimental, and the task of the orthodontist is to make this factor his ally instead of his enemy.* All practitioners who have to deal with the teeth know that persons come to them with suggestion working against them. The suggestion is that the patient is to undergo a most painful operation. A large part of the pain suffered by patients in the orthodontist's chair has no organic cause, but is purely mental. The pain caused by the general suggestion of tradition and the particular suggestion of friends is of long duration and severe. It is the fear every second which is the most difficult to endure. As a matter of fact, only the most bungling orthodontist causes pain in its true sense, but it usually requires several treatments with the most skilful suggestion to remove entirely the fear of pain on the part of the patient. The mother with the best of intentions has done the injury, she instructs the child, "Now you must not cry if he hurts you," "You must be a brave boy," etc., so that the child readily takes the suggestion that he is going to a chamber of torture. Countersuggestions must be made to destroy these.

In general, then, the office room should be fitted up so as to be attractive to children—light rooms, bright decorations, furniture comfortable for children. The waiting rooms should be provided with books for children and youth, and a liberal supply of new and attractive games—so that the children will be delighted to come and loath to leave. The attendants should be instructed that the chief part of their duty is to be pleasant to the children—the whole office force should conspire to make the place attractive. The practitioner himself is the key to the situation in this particular, and must not allow anything to interfere with his good nature.

Two psychological laws for use in dealing with patients may now be stated. They are very simple but fundamental. *The first is that a person can not think of two things at the same time, the second is that normal suggestion should be indirect and positive rather than direct and negative.* These laws fuse and coalesce in successful practice.

In taking up the first law and its application to our subject, *let us recognize that while the mind may turn rapidly from one thought to another, only one has our attention at a time, and further, if our attention is absorbed by one idea, all other things are mentally absent.* For our purpose we might speak of our subject as "The Expulsive Power of Another Idea." Let us, for example, take the case of a person sitting in his room suffering most excruciating pain from toothache. Some one in the next room cries out "Fire." The sufferer rushes out, aids in extinguishing the fire, talks about the cause and the effects, and at the end of an hour returns to his room to remember that he had

had a toothache. The ache may return then, or it may be effectively expelled. The patient sits in the chair with mind filled with the thought of being hurt; the skilful practitioner talks of the games in which the child may be interested, the trip up the river, the presents received or expected at Christmas, the child's birthday—anything of a pleasant and absorbing character. With the mind filled with these things there is no room for the thought of pain.

When working about the mouth the suggestion may be such that the experience takes on a new meaning. It takes time and brains, and a certain amount of talent to make most skilful suggestions, but not sufficient attention has been paid to this phase of the work, the practitioner trusting to the inspiration of the moment rather than to preparation for his suggestions, or else ignoring the matter entirely. Remember that if the patient is thinking about your story or his game, his teeth are not paining, and if, as in orthodontia, there is no organic but only mental cause of pain, the pain is more easily removed.

The suggestion should be indirect and positive. *It is better not to mention pain at all.* You may assure the child, "This will not hurt." He may never have thought of hurt, but now that you suggest it he can not think of anything else. Or, on the other hand, if his former suggestion of pain is very strong even a touch to the teeth may be interpreted as pain, and your statement does not carry weight with him the next time. To say, "This will not hurt" is a direct suggestion and should usually not be used. Instead, say something like this, "A little girl who was here yesterday told me there is no place she likes to be so much as in this chair for she always has such a good time here; she likes to have me work with her teeth and wants to come as soon again as I can have her." The patient makes this his own application. Then the positive suggestion always outlines the new idea. If you tell a patient not to think of pain it is practically the same as telling him to think of it.

Not a little malocclusion is caused by bad habits, such as biting a pencil, sucking the thumb, etc. These habits may be so firmly fixed that they can only be cured by abnormal suggestion in the form of hypnotism, but very seldom is this necessary. Usually the active cooperation of the patient and a few skilful and positive suggestions suffice to cure these. Instead of telling a girl that she must not bite her pencil it may be sufficient to call her attention in a casual way to the fact that biting a pencil is a vulgar and dangerous habit because disease germs may be conveyed to the system in that way.

There is practically no branch of the profession so neglected as the psychological, and none that will bring greater returns to study and thought. This is especially true where children are the patients and where injurious suggestions have already been given.

DISCUSSION*

Dr. A. L. Swift.—Although I do not feel competent to discuss this paper, which has been so admirably presented to us, I will call your attention to a few thoughts which have

*The discussion of Dr. Rogers' paper was opened by Dr. R. Ottolengui of New York City, whose remarks, illustrated by a number of lantern slides, especially emphasized the importance of anatomical restoration of tooth forms in all dental operations. The points brought out by Dr. Ottolengui, and the slides used as illustrations, were all presented in a paper read by him before the Panama-Pacific Dental Congress in San Francisco, 1915, and are published in *Dental Items of Interest,* March, 1916.

occurred to me. One of these is the fact that orthodontists who have listened to this paper must feel that there are certain requisite attainments which, if they are to be successful practitioners of their specialty, are of paramount importance; for I think the paper of the evening is most timely, and if I were practicing orthodontia, I should want to take this paper when it is published and go to a quiet nook and study it over carefully to find out how many of these basic requirements I did not possess, and then strive diligently to improve my ability along those lines.

When we see, as many of us must have seen, lamentable failures after long and arduous periods of orthodontic treatment, we often ask ourselves why there is such a vast difference in the results obtained by some and those obtained by others; and after listening to this paper I think we can more easily answer that question. Few men have been more deeply interested in watching the wonderful strides made by this branch of our profession than I; yet we have only touched upon the borderland of the wonderful blessings to humanity which orthodontia will accomplish in the fullness of time. The muscle exercise as suggested by the essayist is, I think, most important. I was speaking to Dr. Rogers before the meeting, and he mentioned a method of exercising certain of the facial muscles by having his patients use a little bicarbonate of soda in water, and by using the buccinator and other muscles, forcibly driving the liquid back and forth and around the mouth with the teeth closed, using this one mouthful until the muscles become tired, then expectorating, resting a moment, and following it up again in the same way a number of times. This recalled to me that in the treatment of pyorrhea I have suggested the same method,—not for the muscle exercise, of course, but for the forcible driving of a liquid through all the spaces and through the pockets, thus helping to keep the spaces and the pockets clean. It is really wonderful how much force can be developed by constant practice with the mouth filled—not overfilled, but with the proper quantity of liquid.

I have no use for the syringe which Dr. Black suggested, as I find that by insisting upon the patient's practicing this use of the muscles the force with which a liquid can be driven through the spaces and pockets is sufficient to keep them wonderfully clean. One who has never tried it will be surprised by the results, particularly in cases where there is considerable loss of mucous tissue in the interdental spaces.

Normal occlusion and proper contact points, as well as the little grooves which Dr. Ottolengui so graphically explained to us, are most important; and in the treatment of pyorrhea the proper adjustment of contact points and the occlusion are essential to success.

I do not know that I wish to refer to anything else. I have not had the privilege of reading the paper. I simply had the synopsis which was sent to all the members and the essayist has covered the subject so thoroughly there is very little I can add.

Dr. Oscar Carrabine.—I should like to speak of the psychological part of Dr. Rogers' most excellent paper, as I believe the profession at large has paid little or no attention to the study of psychology.

For myself, I am convinced there is much in this field of investigation that we ought to know. It seems to me it is of the greatest importance that we should recognize man as a mental as well as a physical being and I shall make a few suggestions that may add something towards gaining a better understanding of this subject.

So much has been written and so many theories have been advanced that one is at a loss to know just how and where to begin, but for those who wish a better understanding of this subject, I would suggest a book written by Thomson Jay Hudson, entitled "The Law of Psychic Phenomena."

Dr. Hudson is, I believe, the first man who classified the human mind. He believed in the dual mind of man; that the line of demarcation between the two was clearly defined; that each was endowed with separate and distinct powers, and he distinguished the two by designating the one as "objective" and the other as "subjective."

The importance of a knowledge of the law of suggestion, its normal application and its effect upon the physical functions and senses of the body, is something that each and every one of us should know.

Dr. Leuman M. Waugh.—The paper to which we have listened this evening must be accepted by us as a sincere message based on successful practice. The simple and comparatively delicate appliances, by which the developmental changes have been brought about, is most pleasing. It serves further to prove that the more powerful forms of arch and the use of ligatures, about nonbanded teeth, which we formerly employed so generally, can be dispensed with. By this means, it is possible largely to overcome two very objectionable factors, one being the difficulty of cleansing the tooth surfaces about the ligature and the second and probably equally important, the irritation to the gum margin.

For, after all, the subgingival space should be most carefully guarded in all treatment of the mouth; and the orthodontist should be especially careful not to bring about wounds of the free margin of the gum. I presume the essayist uses the lighter arch wires—about .030, as Dr. Angle recommends, in his pin and tube appliance, and that is probably sufficient to bring about any changes necessary at the proper age for treatment. I believe we must more and more recognize that our purpose can be better served with such appliances as interfere as little as may be with the individual movement of the teeth during treatment.

As to the age at which orthodontic treatment may best be given, although no age was mentioned, many of the slides showed that it was begun early, some at the tender age at which the natural spacing of the deciduous teeth should take place, which is at from three and one-half to six years. The general rule is that treatment should be begun as soon as a deformity becomes sufficiently pronounced to be apparent that Nature can not correct the condition without aid.

Between the eighth and twelfth year, the greater change normally takes place; and by aiding at a period when Nature is bringing about the greatest developmental change, we are working more in harmony with the physiological forces.

I agree with Dr. Swift when he says that all dental practitioners should be interested in this subject, and I further feel that all of us should really study this paper.

The work of the general practitioner and orthodontist should go hand in hand. An orthodontist has the little patient for a few years only, and then the patient is returned to the exclusive care of the general practitioner, we hope, with teeth in good occlusion and with facial harmony. But as Dr. Ottolengui emphasized, no matter how well the teeth may have been placed in proper position, no matter how carefully the orthodontist has done his work, that nice work may be disturbed most easily by restorations not made upon the principle of normal occlusion harmonized with the conditions present in the mouth at the time. Therefore, by all working in harmony, and criticizing each other kindly—and only kindly—may we hope to attain to a higher grade of "all-inclusive" dental service, which must be the ultimate aim of every sincere practitioner whether in general or special practice. And the essay of this evening, if we will study it thoughtfully, should be helpful to this end.

Dr. Rogers.—I am glad that Dr. Ottolengui supplemented my paper by his very timely and interesting suggestions. I think that every orthodontist has recognized the importance of his subject, and is desirous of awakening a sense of duty in this respect among the general practitioners.

I enjoyed the other discussions and appreciate and agree very heartily with what has been said. If any of you should study and undertake the work of muscular development of the facial muscles, you must not become discouraged if you do not get results at once. It is a comparatively new field, and the application of the various exercises must only be made after careful study, and thorough understanding of what is required. Some thoughtless people might prescribe exercises where the conditions present called for some different line of treatment. I believe the orthopedic surgeon will, in the future, prove to be of great benefit to us in our work. In cases not needing his attention, the general posture exercises can not fail to be beneficial. Parents appreciate their value, and children like to do them. These exercises tone up the whole system and improve the digestive apparatus; and they stimulate greater mental activity. The patient gains greater respect for himself. Children are ready to help, if we are willing to explain the exercise properly. Tell them they will grow vigorous and strong, and few will fail to take interest in the idea.

THE HISTORY OF ORTHODONTIA

(*Continued from page* 250.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY

JOHN NUTTING FARRAR (1839-1913) Father of Modern Orthodontia. At just what age Farrar became interested in orthodontia, historians have failed to enlighten us. From the following lines, written by this great pioneer himself, we presume it must have been very early in youth for he says, "The first regulating operation performed by the author was upon one of his own upper central incisors, when he was a small boy. This outstanding tooth was moved into line by pressing his finger upon it several times a day for several weeks." It matters little whether this was the beginning, or the cases reported

Fig. 1.—John Nutting Farrar (1839-1913).

in 1872-3, we nevertheless find the year 1875 the turning point in his professional career for at that time he began to publish the results of his experiences and experiments. From a crude beginning we find later evolved the first, of the many, systems in Orthodontia.

Before the Brooklyn Dental Society, April 12, 1875, Farrar read the first of his many papers, the title of which was *An Inquiry into the Physiological and Pathological Changes in Animal Tissues in Regulating Teeth.* This series of articles some thirty-eight in number he later published under the title of *Regulation of the Teeth Made Easy by the Positive System.*

These are to be found principally in the *Dental Cosmos* and were sharply criticised by his fellow-copractitioners. However, in time, those who were the most prone to condemn, were his staunchest friends.

This first distinct "system" of regulating teeth was based upon the screw as a motive force. His ideas were far in advance of his age, most of his papers "were constructed to serve a double purpose; namely, to set forth some esthetic or theoretic principle and to illustrate the application of the same to practice." The underlying principle of his work is found in the preliminary chapter, vol. 1, page 13, of his work.

"One of the cardinal principles, especially advocated in this work, is the importance of the observance of the physiological law which governs tissues, during a movement of the teeth (by means of art), the object being to prevent pain. To insure this result (exemption from pain), the pressure by which the movement is to be effected should be under the control of the patient, a requirement which implies the use of instruments capable of being operated and adjusted at will. By this maximum rate at which it is possible to move teeth painlessly can be ascertained. But while the system expressly advocates the use of 'controllable' mechanism, and of intermittent force, when practicable, the assertion made by hostile critics, that the use of continuous force, is wholly disapproved of, under all circumstances, is untrue.

"The idea of taking advantage of the functional laws of the tissues to prevent pain, appeared to me (at the time of its conception) novel, and yet so rational that, when fully appreciated, it would be available in general surgery as well as in dentistry. To determine this rate and test its value, I made a series of experiments which extended over a period of several years. The results were made known to several professional gentlemen in 1873; and in February, 1874, this topic was the subject of my graduating thesis at Jefferson Medical College, and afterward read in the main before the Brooklyn Dental Society, April 12th, 1875, and published in the *Dental Cosmos,* January, 1876."

Dr. Farrar was the originator of the broad theory of *Intermittent Force* in regulating teeth, this being considered not only the proper method physiologically but also proving the most effective one.

In 1888 Farrar, after fifteen years of conscientious labor, gave to the profession what was undoubtedly, and still is, the greatest work ever issued on orthodontia. Too much honor can never be bestowed on him for these two volumes, the third never having been published. His *Treatise on Irregularities of the Teeth and their Correction* contains over fourteen hundred pen and ink sketches, drawn by the author himself, and has some fifteen hundred and seventy pages. These volumes are a veritable mine of orthodontic knowledge, epoch making in character and more than profitable reading to those engaged in this specialty. This great work was founded upon the results of active experience carefully recorded from 1863 to the publication of the work.

The author's aim in these volumes was to make every appliance self-acting, at the same time the dynamics being such that the patient would be practically unconscious that "regularity was taking the place of irregularity in the mouth." In regard to the force he adopted in his "system" Farrar says, "When I first made the broad statement that the screw was capable of being used in more

forms than that of the screw jack, and that the screw might be made to play an important part in the correction of nearly all conditions of irregularity, the assertion was said, by many, to be absurd. Even the screw jack now admitted to be adaptable to many conditions with wonderful results, was then thought to be capable of very limited service."

In regard to the effect of forces, Farrar says, Vol. II, p. 758,

"Teeth will move in any direction by force continuously maintained, or frequently repeated for a sufficient length of time. The force may be within the tissues of the jaws, as exemplified in cases where liberty, by extraction of an interfering tooth, is followed by natural adjustment of the obstructed tooth, but perhaps it is more satisfactorily shown in cases where the force is furnished by the finger, or is obtained from a machine. The first aim, however, in any operation for the movement of a tooth is to cause slight looseness, by more or less decalcification of its socket-tissues, a condition that results from pressure of the tooth upon these tissues. This softening of the socket breaks the fixedness or rigidity of the tooth, leaving it comparatively easy to be moved either by absorption of the tissues or by bending of the alveolar process, or by both.

"The proper correction of teeth by machines lies in applying the force in the right direction and in a philosophical way. To elevate teeth in their sockets, the direction of force applied is similar to that for extracting them, the difference in results depending upon the amount of force applied in a given time. For movements in other directions, philosophy is also the basis. Teeth can be moved in any direction by brute force simply, but to move them in the best way depends very much upon a high quality of intelligence behind the hand.

"If these facts are clearly understood, it will be seen that to move a tooth, all depends upon applying a proper degree of force; and to successfully regulate a tooth, by any of the various plans, depends not only upon furnishing force, but upon applying the engine of force so that it will bear or draw upon the right place. If the object is simply to elevate the tooth, all that is necessary is to cause the force to act in the line of its long axis, and in the direction of the end of the crown; but if the object is to move the crown posteriorly or anteriorly, the force should be applied so as to act at right angles (or nearly so) to the long axis of the tooth.

"Thus far we have gone along the lines of general principles; but there are several related factors that cause deviations from these general lines in operations upon the front teeth (especially the upper), that should be taken into consideration. These deviations are caused by the socket resistance acting upon these teeth (being moved) like fulcrums; that is, some of these teeth tilt upon places somewhere within the middle third of their long diameter. [Page 765.] To move both the crown and the root bodily forward (sometimes necessary in elongating the dental arch) requires the application of forces that will act in opposite directions; or, perhaps more clearly expressed, the mechanism must be so constructed that the crown can be held firmly and given gradual liberty to move forward, as the root is made to move forward.

"*Brief of Author's Theory.*—Teeth are moved through absorption of the socket-tissue, or by bending of the alveolar ridge, or both. This absorption, or this bending, may take place by the tissue alterations being carried on within

their physiological functions, or outside of these healthy functions and in the pathological. If the tissue-changes can be conducted within the physiological functions, the operation of moving a tooth will be painless; but if the rate of changes be pushed beyond this condition, into the pathological, there will be more or less pain.

"Any regulating mechanism that can be controlled so as to confine the tissue-changes within the healthy line is therefore superior to those that can not. Mechanisms that operate by elastic rubber or by metallic springs, if the power is not so great as to force the changes to exceed healthy action, will be comparatively painless; but to control elastic materials so that they will not cause pain is generally difficult and often impossible.

"This is not the case when mechanisms operated by screws can be used, because by the screw exactness can be secured, and precisely the proper degree of force can be given. Especially is this true when the management of the mechanism is left to the patient, who knows better than the operator when the greatest degree of force can be given without causing pain. This desideratum is assured by the screw making it possible to take advantage of the law of labor and rest, which applies to this kind of tissue-action as well as to all other tissue-energies."

At a banquet given him by his friends in 1908, Farrar explained his position as to specialties in dentistry, in a way worthy of remembrance. He said, "I regard the profession of dentistry as equal to any profession in the world. Is there any profession or any branch of medicine that can relieve the amount of pain and suffering that we do? I think not. I have always made my study of the profession as a whole, and am an all-around dentist today, have practiced every part with equal knowledge. I have no specialty, unless all the branches are specialties and altogether amount to a great specialty called dentistry. I can not understand how any one can undertake to be a specialist in dentistry who is not an all-around dentist. . . . I advise young men to learn all branches of dentistry equally well, and never give up the other branches to follow a specialty. If a dentist thinks he can follow a certain line better than any other, he can get a reputation as a specialist, but no man can treat a particular branch successfully unless he is a master of every branch of the profession beforehand."

The following prophecy from the pen of Dr. Farrar in the *Dental Cosmos,* January 20, 1878, has been more than fulfilled and illustrates the farsightedness of this great thinker.

"Although the simplification of regulation has been a great desideratum for many years, it has for some time been evident to me (though by most people thought to be impracticable) that the time will come when the regulating process and the necessary apparatus will be so systematized and simplified that the latter will actually be kept in stock, in parts and wholes, at dental depots, in readiness for the profession at large, so that it may be ordered by catalogued numbers to suit the needs of any case. So that by a few moments work at the blow-pipe in the laboratory the dentist may be able, by uniting the parts, to produce any apparatus, of any size desired, at minimum cost of time and money." The importance of this prediction was not readily grasped at that

time, but today we are fully aware of the results of this standardization of orthodontic appliances.

Farrar also realized the necessity of bringing about a new arrangement of the two dental arches so that normal articulation would result. His devices were far too numerous and the complication of their character undoubtedly prevented their general adoption.

Under *An Inquiry into Physiological and Pathological Changes in Animal Tissues in Regulating Teeth, Dental Cosmos,* 1876, page 13, we find, "In some cases the correction is easy and simple, producing little or no pain or inflammation; in others the operation is difficult and tedious, accompanied by pain and inflammation. Are these differences owing entirely to a difference in the constitutions of different people? or do they mainly lie in the *manner* the operations are performed?

"This led me to consider various well-known operations in surgery and it appeared evident that all of them which depend upon pressure, such as dilating strictures, ligation of tumors, and regulating teeth, involve and are subject to much the same physiological laws. To illustrate the operation of these laws in one class will explain my idea of all.

"The treatment for regulating teeth was instituted for correcting a defect where the eruption had taken place in a crowded, irregular manner in the arch, producing deformity of the features, incorrect articulation of speech, lisping, imperfect mastication, etc.

"In moving teeth, the slight inflammation of the alveolar process at the point in the socket in the rear of the departing teeth, causes in the same way (so far as we are able to judge) a deposit of cartilage material in the space left.

"It will be seen that in this act or movement of a tooth a double physiological operation is going on,—absorption on one side and deposit on the other. Exactly how this absorption takes place is not well understood. First, pressure is a primary cause, and absorption the result. These are facts we all can see.

"As it is so common to theorize, I may be pardoned if I give here my views. The pressure of the tooth upon the soft alveolar process, or socket, causes more or less devitalization of the contiguous cells, which are broken down and carried off by the absorbents, which possibly are somewhat stimulated by the slight inflammation acting upon them through sympathy from contiguity and continuity, while the advancing tooth, interfering with the blood nutrition, prevents new cells taking the place of old ones. Thus the tooth moves as fast as the cells give way before it. In other words, the tooth advances by 'displacement.'

"On the opposite side of the tooth the reverse of absorption is going on. The tissues are constantly separating, and the space between the departing tooth and the socket-wall is filling with new cells, formed from the exuding plasma.

"In the treatment for regulating teeth, the operator meets many obstacles, especially in the construction of apparatus to obtain desired results. The

great desideratum in his mind *has* been to *move the teeth,* without much regard to physiological laws.

"Teeth may be moved in any direction from one-fourth to one-half inch, and in some cases even more. Generally they are moved laterally, but may be depressed or raised in their sockets. The principal apparatus, except those on the inclined-plane principle, is, and always has been (since this branch of the profession has been vigorously prosecuted), made of rubber, so secured to the teeth by ligatures and metallic bands as to keep up a constant tension on the tooth to be moved. This constant traction, after a day or two, starts the tooth from its old home a very short distance. It continues to move slowly

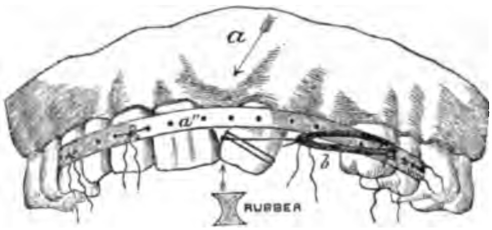

Fig. 2.—One of Farrar's first cases, treated by the rubber plan (1876).

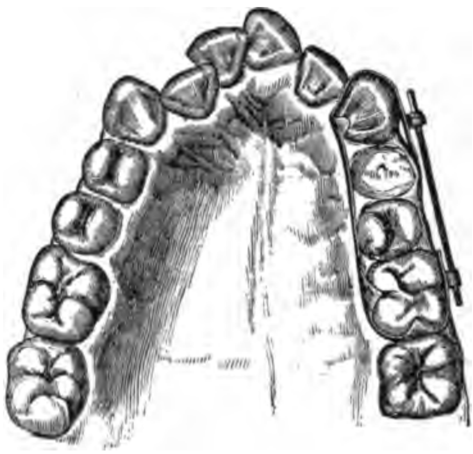

Fig. 3.—Represents the first step for treatment with the gold band and screw applied (1876).

from day to day, from week to week, as long as the tension is maintained, the apex remaining comparatively stationary as the crown advances.

"It is found that the unfavorable cases are those in which the tooth has been moved a considerable distance, the operation having been accompanied by much inflammation and pain, as before mentioned, while those moved but slightly have caused little or no pain or inflammation, requiring but short treatment. Therefore the difference must arise from the degree of tension, or length of time, or both.

"From these considerations, it will be seen that undue pressure upon the tissues will, if allowed to remain too long, produce inflammation, and will also modify or arrest the action of the absorbents, and all together produce unhealthy changes in the parts involved. On the other hand, tissues can receive

a moderate amount of pressure, causing absorption, and yet not passing beyond healthy action. Therefore there *must* be a dividing line within which we may operate successfully, and beyond which we can not."

One of the first cases Farrar treated is shown in Fig. 2 and represents a specimen in his cabinet, treated by the rubber plan; *a* represents position of the left central incisor under the gum, erupting six years after the mate; *a,"* gold band; *b,* rubber ring, under tension; the ligatured tooth is a left lateral incisor in contact with one right central incisor.

A very thin gold band was fitted around the cuspid (Fig. 3) and extended back along the lingual surface and around the first molar tooth, leaving a space between the ends of the gold strap on the buccal surface of about six-eighths of an inch. On each extremity of this strap of gold, at right angles, was soldered a nut, through one of which was cut a screw-thread. Through these nuts passed a screw one inch in length, having sixty threads; the screw being fitted at the anterior or mesial extremity for a watch-key. (Fig. 4.) This simple apparatus having been applied, the screw was turned so as to cause a slight sense of tightness, or pressure, but not enough to produce pain. This sense of tightness passed away after about an hour, leaving no unpleasant feeling whatever. Even the instrument caused little or no inconvenience. The

Fig. 4.—Represents the simple band and screw with a key applied (1876).

screw was turned one-half of a revolution morning and evening,—thus advancing it one-half of a thread, or 1/120 of an inch by each operation, or 2/120 of an inch per day.

"It should be borne in mind that the gold band had but one screw; consequently, when it was advanced 1/120 of an inch, the tooth only moved half that distance, or 1/240 of an inch, at each operation, and, as the operation was performed twice every day the tooth moved 2/240 of an inch, or 1/120 of an inch per day.

"From these experiments we deduce the following conclusions:

"1st. That in regulating teeth, the traction must be intermittent, and must not exceed certain fixed limits.

"2d. That while the system of moving teeth by elastic rubber apparatus is unscientific, leads to pain and inflammation, and is dangerous to the future usefulness of the teeth operated upon, a properly constructed metallic apparatus, operated by screws and nuts, produces happy results, without pain or nervous exhaustion.

"3d. That if teeth are moved through the gums and alveolar process about 1/240 of an inch every morning, and the same in the evening, no pain or nervous exhaustion follows.

"4th. That while these tissues will allow an advancement of a tooth at this rate (1/240 of an inch) twice in twenty-four hours, the changes physio-

logical, yet, if a much greater pressure be made, the tissue-changes will become pathological.

"The Law. In regulating teeth, the dividing line between the production of physiological and pathological changes in the tissues of the jaw is found to lie within a movement of the teeth acted upon—allowing a variation which will cover all cases—not exceeding 1/240 or 1/160 of an inch every twelve hours."

In the *Dental Cosmos,* 1877, page 519, under *Rotating Teeth in Their Sockets in the Process of Their Regulation,* Farrar stated:

"The main points necessary in the successful regulation of teeth are, firmness of application of the instruments and minuteness of the apparatus, in order to facilitate management and secure the ease and comfort of the patient.

"Clumsiness of apparatus is a great stumbling block to the success of operations as well as the reputation of dentists. The idea of a wrench application is not new, though original with me. Dr. Atkinson has used something of this sort, made after the shape of an old-fashioned, long handle dipper, fitted over the tooth, with the handle used as a lever; but this device lacked firmness of attachment,—a defect that is fully overcome by my plan.

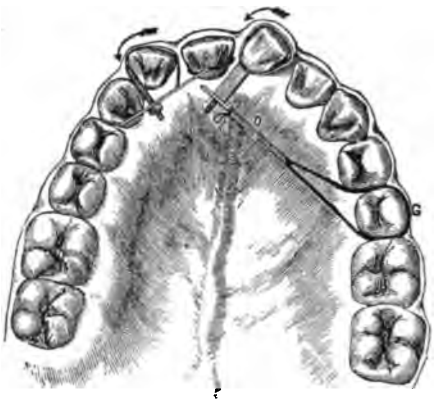

Fig. 5.—Method of rotating teeth (1877).

"Fig. 5 represents one of the forms of these devices, and the ordinary methods of their application to the teeth.

"The apparatus should be made of eighteen-carat gold, unless it be the screw, which is often more durable if made of brass."

Under *Regulation of Teeth Made Easy* in the *Dental Cosmos,* 1878, page 18, we find the following:—

"My object is to show the advantages of a system founded upon principles, and at the same time illustrate the typical forms of apparatus necessary to show that this hitherto most difficult branch of our business may be made not only easier, but more scientific, by what may be called a positive system of mechanism, conducted in harmony with physiological laws. This system may be successfully practiced by any patient dentist of ordinary ability, who clearly understands the laws of mechanics involved, and the laws governing physiological and pathological changes of animal tissues while under pres-

sure, in order that the line between the two conditions may not be overstepped. The pressure upon the tissues should be intermittent, and only carried so far in degree as to be within the area of physiological or healthy action, and not beyond and into that condition called pathological; by the careful avoidance of which any movement of the teeth may be made without producing inflammation, and with little or no pain."

"It is not claimed that the pursuance of any *one* system *under all circumstances* is a guarantee against difficulties, as these are liable under any system, and it may be necessary to resort to other methods to gain some points.

"An inventive mind will suggest various ways and means to accomplish this point, but the accompanying illustration (Fig. 6) will be sufficient to meet the difficulty in most cases.

"The clamp or box-wrench (Fig. 6) having been firmly secured to the tooth, according to explanations, and the side-draught apparatus applied, a

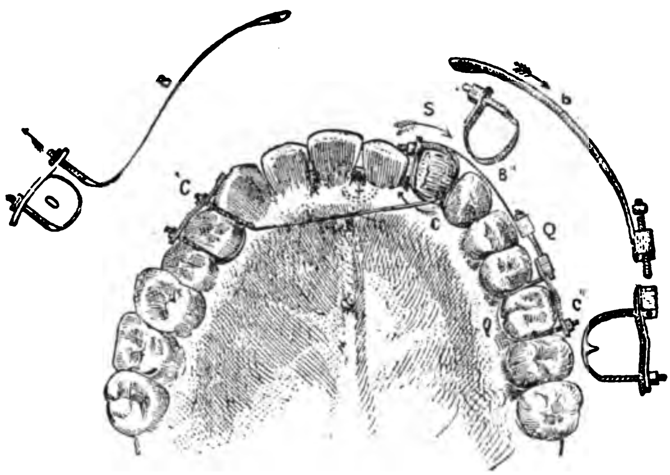

Fig. 6.—Appliance used in 1878.

counter-action is produced by securing a clamp, *C,"* around some distant tooth, *O* for anchorage; and having connected the two devices by means of a thin metallic (gold or platinum) band, *B,"* with one end first secured to the anchor-clamp around the distant tooth by means of a bolt, *Q,* through a smooth nut soldered to it, and the other punched end caught over a pin, *S,* soldered on the band of the clamp *C,* a corresponding offset force can be made by tightening the screw *Q,* which will cause the band to draw upon the box-wrench or band *C,* as illustrated in the diagram, which at the same time assists in the rotary motion of the tooth, care being taken always not to tighten this (as likewise with all regulating apparatus on the screw principle) more than will be comfortable to the patient. Just enough to feel comfortably snug, will, I have found, be about the right degree of pressure to be in accordance with the above law.

"Two of the greatest advantages recommending the positive system are firmness of the apparatus in the mouth, and the fact that, with a little instruction the patient is enabled, by the use of a properly made key for turning the

nuts (night and morning), to do a large part of the regulating work at home; thus rendering it unnecessary to go to the dentist oftener than once or twice per week, and sometimes not oftener than once in a week or two.

"Page 80. There are three principal forms of irregularity,—those without the esthetic line of the arch, those within this line, and the mixed forms, covering both the former. Leaving the two latter for future consideration, we will confine ourselves in this paper to the first. The third class, or the mixed variety, is the most difficult of regulation; the other two, though generally requiring about the same time, are more easily managed; and, though the apparatus may require considerable skill, the working of it is exceedingly simple.

"The entire practice of regulating teeth may be summed up under the following aphorisms or fundamental rules for constructing and operating mechanical appliances for such regulation, and which, it seems to me, will be self-evident to those who understand the philosophy of the positive system in theory and practice:

"1st. All mechanical appliances for regulating teeth should, if possible, be constructed upon the principle of the screw or inclined plane.

"2d. All apparatus for regulating teeth should be constructed with the view of being worn inside the mouth.

"3d. All mechanical appliances should be so constructed as to cause as little pain and inconvenience to the patient in speech and eating as possible.

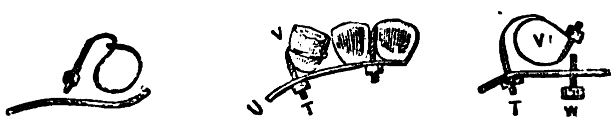

Fig. 6-*A*.—Represents a simple little rotating apparatus that sometimes may be made of great service. The nut *T*, when tightened, draws the nut through the bar *U*, and being attached to the band-clamp *V* on the opposite side of the tooth causes the tooth to rotate, and at the same time drag backwards if desired. Should, however, this latter movement be undesirable, it may be prevented by a little screw, *W*, passing through a threaded hole in the bar *U*, which, impinging against some point (or nut) as shown, holds the tooth in position (1878).

"4th. All apparatus should be constructed as minute and as delicately as possible, and be capable of doing its work with certainty and effect.

"5th. All appliances should be so constructed as to relieve the patient as much as possible of the necessity of going to the dentist to have it adjusted; in other words, so that the patient can, with a little instruction, do most of the work, by means of keys to turn the screws and nuts.

"6th. Forces for the movement of the teeth should be applied once in about twelve hours, and as powerfully as possible, short of causing pain,—a point which may be best determined by the patient.

"I take an impression of the jaw and teeth (generally in wax), and having made a cast, sketch it upon paper, and, with the cast and patient before me, and a knowledge of the median line and lateral sway (if any), I indicate by arrows on the diagram, the line of direction in which the tooth should be moved, which serves as a guide in the construction of the regulating mechanism; after which the apparatus is made up.

"Having determined upon one or more posterior teeth (molars or bicuspids) on each side of the jaw to be used as anchorages, a band clamp (Fig.

7) (A) made of very thin (like paper) gold or platinum, about one-tenth of an inch wide, is constructed to fit around them firmly, by means of a bolt (B), passing through nuts C, C' (one plain and the other threaded), which are soldered, one to each end of the band (A), as represented in the cut. To prevent these clamps from working down and impinging upon the gums, they should be cut from plate wide enough to make one or two ears (D) in suitable places, which, when bent over and into the convolutions of the grinding surface, act as stays to prevent undesirable movement. Should the teeth be short, the bands may be made to hold firmly to the teeth by soldering on the inside clamp a small pinlike point, X, which will fit a small hole drilled into the tooth.

"Connected with these anchor-clamps by means of a little hook and ring (not shown in the diagram) or by solder, is a slim swaged platinum U-shaped plate, about one-quarter to one-half of an inch wide, which extends forward along the inner wall of the dental arch to within about half an inch of the

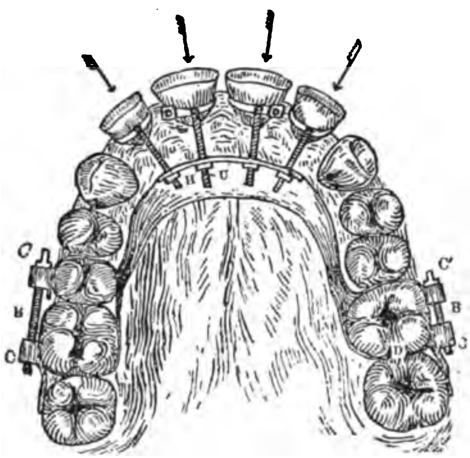

Fig. 7.—Method of retracting anterior teeth (1878).

protruding teeth, and which lies flat and snug to the gum and roof of the mouth.

"On the front margin, and in line of the forces to be given, are punctured ears (H), bent at right angles with the plate, or as many smooth-bored nuts (not shown in the cut) as there are teeth to be moved, through each of which passes a small bolt (E), having on the threaded end a nut (F). On the dental extremity of these bolts or screws are soldered loosely, in the eye of each a small ring (not shown in the cut), each of which bolt-rings is connected by solder or hook to little metallic clamp-bands secured firmly around their respective teeth. Sometimes, when it is found that the bulk of the rings or screws would require that the lower incisors be cut away too much in order to prevent contact, it is an excellent plan to solder a small piece of thin (clamp) plate between the clamp and the screw, which will take up but little room, and will be as pliable as any ring-joint.

"When the teeth are fully regulated they should be retained in position for at least a year, perhaps longer. This may be done by a delicate apparatus made

of narrow bands and strips of gold around the teeth, and secured to a delicate rim of plate work or plate wire connected with the bicuspids; or they may sometimes be retained by wearing a simple suction plate, having gold fingers passing between the teeth and bent nearly at right angles in front. Whatever the apparatus be, it should be kept clean and free from collections of food."

Page 307: "In the February number of the *Dental Cosmos* was explained one form of apparatus for regulating protruded upper front teeth separately."

"Fig. 8 illustrates a different modification of the apparatus for accomplishing the same object collectively. The apparatus is made to draw upon the outstanding teeth by the tightening of the nuts (*a*) similar to that device

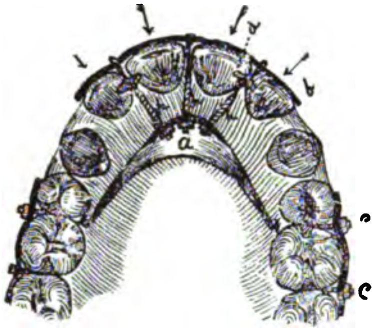

Fig. 8.

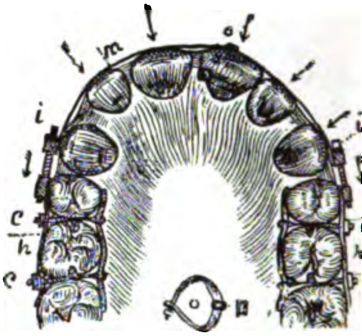

Fig. 9.

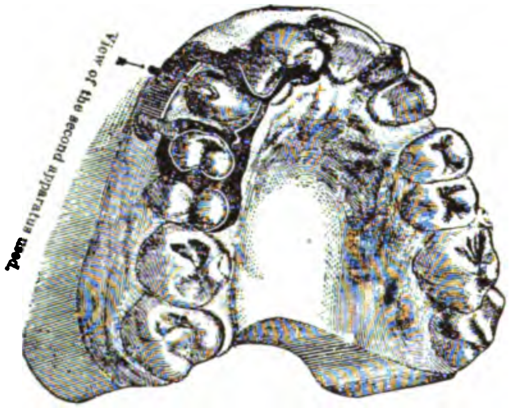

Fig. 9-A.—Elevating a cuspid (1878).

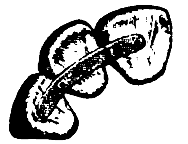

Fig. 9-B.—Retaining apparatus in position (1878).

explained in Fig. 7, but differs from it in construction in applying the forces to the teeth by a bar or plate (*b*) extending across all of the teeth to be moved.

"In all the accompanying figures, the arrows indicate the direction of the movement of the teeth operated upon.

"Fig. 9 illustrates another form of apparatus which acts upon the teeth collectively, also by means of a band (*m*) extending along the outer surfaces, and which is made to force against the teeth to be moved by tightening of bolts which pass through smooth-bored nuts (*i, i*) soldered to the ends of the band (*m*), and which enter threaded nuts soldered to anchor-bands (*h, c*) secured around the back teeth as shown. The bar *b* of Fig. 8 and band *m* of Fig. 9

should be prevented from impinging on the front gum by passing through the eye of a clamp-band *o*, secured to a front tooth, or, better still, by having a *T* soldered to the inside, so that the top of the *T* shall rest on the lingual surfaces of the central incisors."

Page 74, *Dental Cosmos*, 1879, "*Bands.*—All fixtures of this sort should be as delicate as possible, consistent with the necessary strength. The general tendency is to make apparatus too clumsy. On delicacy and accuracy of fit everything depends. One of the most important points to hold in mind is proper thickness of material. While the anchor-bars (not bands) may be of considerable thickness, those straps which reach from the anchorage to the teeth to be moved should generally be thinner, especially those portions which are intended to slip around the teeth when tightened by the bolts. A disregard of this point may lead to failure.

"The thickness of bars for molar teeth to which anchor-bands are secured (Fig. 10) should be about Nos. 22 or 23; for bicuspid teeth about No. 34 or 35, and in breadth not greater than is absolutely necessary for strength and firmness, say from 2/32 to 4/32 of an inch."

Page 607. "We will pass on to consider another plan of accomplishing the same purpose, which, although also old in principle, is worthy of mention,—the use of pieces of plate bent from time to time, so as to maintain sufficient temporary force against the teeth. (I do not include that class of appliances which are so constructed as to maintain continued pressure.) This

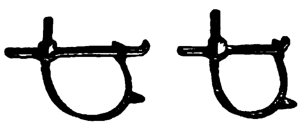

Fig. 10.—Anchor band (1879).

plan is practical with variously constructed fixtures, from a size less than that of the smallest tooth to that of the roof of the mouth; but, as a rule, small fixtures of this variety give the best results. First, for instance, a small piece of thick plate, an eighth of an inch or more wide, and half an inch or more in length, bent somewhat into the form of the letter U, can be made by being opened more and more, from day to day, to spread teeth sufficiently apart to insert an artificial one. By the use of longer bars or narrow plate, constructed on the same principle, extending across the mouth, secured to teeth in pits or by binders for anchorage, they may be made to successfully move teeth into line which have erupted in the posterior position on the opposite side of the mouth.

"Irregular and protruding front teeth may be drawn into position by the same plan, by occasionally bending metallic fingers extending from a plate secured inside of the mouth, and passing between or over the cutting edges of the teeth. This variety of fixture, although old and well known, is a favorite with many dentists.

"Besides the lateral movement of teeth, rotation may be accomplished to a certain degree, in some cases, by occasional bending of these metallic fingers.

"It may be thought that a nut facing towards the back of the mouth, as

suggested in some of my previous illustrations (Fig. 7) may be difficult to manage; but it is as easily operated as in any other case by properly made keys. While most of my fixtures are worked by the straight and curved 'box-keys,' flat, open wrenches, or by pointed levers, which fit into holes, I have a right angle key (Fig. 11) made to work on bevel-gearing similar to that used for right angle drill attachments to the dental engine; which enables a patient to operate the screws and nuts of any fixture, in any part of the mouth, as easily as he could wind his watch."

Page 302, 1881. "*Reasons of Success and Failure of Mechanisms Depending upon Unaided Impingement, Arising from Position and Shape of Teeth.*

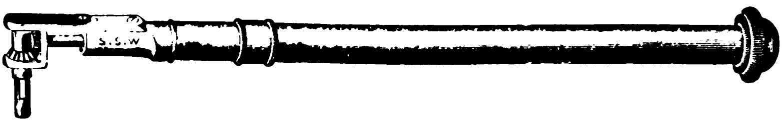

Fig. 11.—Key to allow patient to operate the screws and nuts.

"There are two means of retaining regulating devices in position: By impingement against the teeth, perhaps more or less assisted by the unevenness of their surfaces. 2d. By binding with strings, wire, or perhaps by lodgment on surplus plugs in cavities.

"*First Proposition. In order to obtain scientific accuracy in regulating teeth by impingement, the direction of applied forces should be made on the plane of the shortest line, between the opposite points of impingement, by the mechanism across the jaw.*

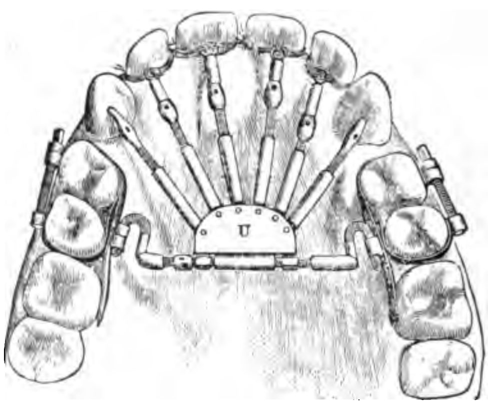

Fig. 12.—Enlargement of the arch (1882).

"*Second Proposition. Position and shape of teeth govern the applicability of the principles of the first proposition.*"

Page 76, 1882. "*Enlargement of the Arch.* A different device, made of gold, which could be bound to the teeth so that it could not slip off was used. It consisted of a system of jack-screws capable when used entire of acting upon twelve teeth at the same time, as shown in Fig. 12.

"In this case, however, only a part of it was applied at first, the remaining portion being added at a later period in the operation. The portion used con-

sisted of a double yoke jack-screw, with a bar extending against the first molars, which was firmly bound to the bicuspids by means of screws and nuts.

"The use of this portion of the apparatus was to force still further outward these six side teeth—four bicuspids and two first molars. During the latter portion of the time that this fixture was being used separately, a cylindrical spindle jack-screw was placed across the mouth, the points of which were set in little artificial pits, made in the lingual surfaces of the cuspids, for the purpose of forcing them directly outward before being carried forward.

"When it was convenient for the patient to visit me the retaining plate was removed, and the yoke jack-screw, which as before said was a portion of a larger apparatus was reinserted in its former place, not only to hold the four bicuspids and first two molars in position, but to serve as foundation to support the other portion of the compound system of jackscrews above alluded to, for the purpose of forcing outwardly the six front teeth. This portion consisted of six spindle-pointed jackscrews attached by rivets or sockets to a body, *U*, as shown in Fig. 12, which was fixed to the larger and more powerful yoke jackscrew on the side teeth. These six screws radiated from the body, *U*, like the sticks of a spread fan. The radiating principle used in the fan portion of this machine, which for a long time I supposed was entirely original with me, I am happy to acknowledge I subsequently learned from Garretson's *Oral Surgery* had previously been used in a somewhat similar way, though I think in a rather primitive degree of development, by Dr. A. Westcott. With this apparatus resting upon the firm yoke jack-screw in the rear, and the points of the spindle jackscrews firmly set in gold sockets tied to the four front teeth, as illustrated, these teeth in exactly one month were carired into the desired positions."

Page 186, 1882. *"Straggling Teeth.—Lateral Movement of Roots and 'Righting-Up' of Crowns:*

"The secret of the lateral movement of roots lies in firmly fixing the articulating ends of the crowns of the teeth to be acted upon while force is being maintained at their necks.

"There are two reasons for attempting a change in the condition of straggling teeth; the first is for the purpose of making room for others that are in process of development; the other is purely a matter of esthetics.

"A knowledge of the position of the apices of the roots of teeth is one of the first requisites to a clear comprehension in all cases, in order to proper treatment; for upon this depends the question of the highest esthetic possibilities. This vital point is often overlooked by young operators, and sometimes by older ones.

"As is well known, the direction of motion and degree of power necessary in mechanical leverage depend not only upon the length of the lever but upon the position of the fulcrum and the distance between it and the points of power and resistance. In the simple movement of the crowns of teeth the apical extremities of the roots of which are already in their proper position, the operation is always based upon that law of mechanics which places the fulcrum between the points where the power is applied and that of the resistance. (See Z, Fig. 14.) But, on the contrary, in an operation for the lateral

movement of roots of teeth the power should be placed between the fulcrum and the point of resistance. (See Z, Fig. 15.)

"Fig. 13 illustrates the front portion of the upper jaw in this and similar cases as they appeared when the apparatus was first applied, and also beautifully shows how it is sometimes possible that the same power from the same device, when continued to be used at the same points throughout the entire operation can be made to act very differently upon different portions of the teeth and sockets at different stages of the operation, by an automatic shifting of the place of the fulcrum so that the direction of the force by the leverage becomes reversed.

"In the treatment of such cases (Fig. 13) where the roots as well as the crowns are out of their proper position, it may become necessary at different stages to adopt the principles of both rules of leverage philosophy. To make the matter plain let us refer to four ideal figures, 14, 15, 16, 17, which diagrammatically illustrate four successive stages in such treatment. Let *B* represent the alveolar process; *R, R,* central incisors (straggled); *P,* gold clamp-bands operated with a screw; *F, F,* fulcrum, or places of the fulcral bearings; *C, C, X, X,* places where the teeth have separated from the socket-walls, the arrows indicating the direction of the movement of the different portions of

Fig. 13.—Appliance used for lateral movement of roots and "righting-up" of crowns.

the teeth at different stages in the operation that caused the 'spaces,' and we shall soon see how simple it all is. Now, if the septum, *B* (Fig. 13), which acts in a measure as a fulcrum, be hard and unyielding, and the alveolus about the apices of the roots be soft, the force of the clamp-band about the necks, as shown, would cause the apices of the roots, *R, R* (if fully formed and calcified), to move in the direction of *S, S,* causing separations from the socket-walls at the opposite sides, *A, A.*

"It should, however, be remembered that, in actual practice, instead of the septum being a positively unyielding substance, it undergoes more or less absorption, and possibly some condensation, especially if the applied force should be greater than is required to cause absorption. The effect of this reduction of the fulcrum (septum) under the pressure of the dental lever is to reduce materially the degree of inclination of the crowns referred to. The real attitude of the teeth, after such alveolar changes, is approximately shown by Fig. 15.

"Under such circumstances any force applied to the crowns of the teeth that would be sufficient to draw them in contact at the point O (Fig. 15) would cause separations between the necks of the teeth and socket-walls at the points

C, C, on one side and the opposite movement of the apical portions of the roots (if calcified) would, through this play of the different arms of the lever, cause other separations on the opposite sides of the sockets at *X, X;* both of which 'spaces' would increase, as the case would advance, until the crowns were brought in contact, as shown.

"The first stage in the operation is now completed, and the time for the next has arrived. The object of this second stage is to produce approximate parallelism of the teeth, by causing the apical portions of the roots to approach each other. At this point the curious change, before referred to, takes place in the play between cause and effect, for, by the same power from the same apparatus, the forces act upon the apices of the roots to cause them to return

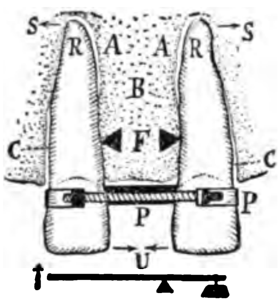

Fig. 14.

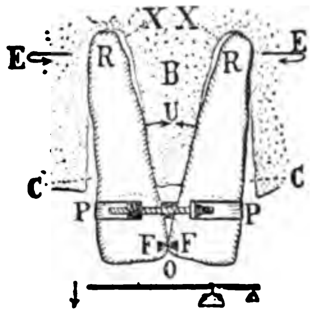

Fig. 15.

Figs. 14 and 15.—First stage of the operation.

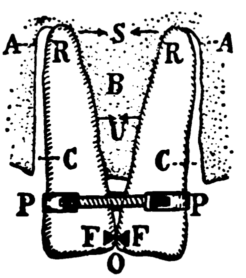

Fig. 16.

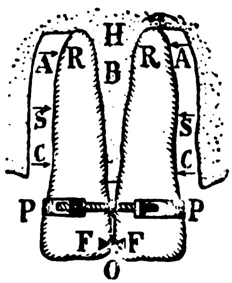

Fig. 17.

Figs. 16 and 17.—Second stage of the operation.

and travel in exactly the opposite direction. (See *E, E,* Fig. 15 and *A, A,* Fig. 16.)

"This change in the direction of movement of the apical extremities of the roots is brought about from the fact that the moment the crowns are brought in contact at the point O,—at that same moment, if the power of the clamp-band be continued, the fulcrum automatically shifts from the position about *B* in the septum to the point of contact of the crowns at *O.* This shifting of the fulcrum changes materially the philosophy of the leverage, by placing the power between the fulcrum and the point of resistance, instead of outside of it. (See *Z, Z,* Figs. 14, 15.)

"Fig. 16 illustrates the relative changes in position between the teeth and

sockets at a little later period in the operation, and Fig. 17 the appearance at its close. The spaces formed by separation of the teeth from their sockets fill in with new, but soft tissue formations as fast as the teeth move. The yielding nature of this new deposit of tissue is the reason why regulated teeth are loose for a considerable length of time afterward, and suggests the reason why they should be kept steady until sufficient time shall have elapsed for calcification. The mechanism which I use in such an operation, as shown by Fig. 13, is made up of two parts; a clamp band, to draw the teeth together, and a lock portion, to hold stationary the cutting edges of the teeth; but while the crowns of the teeth are being drawn together, only the band portion need be used."

Before the First District Dental Society, New York, *Dental Cosmos,* page 153, 1886, Farrar discussed among various orthodontic problems, the question of *Shortening the Dental Arch* and showed many devices to accomplish his purpose, saying,

Page 159: "In constructing devices for regulating teeth, especially for large operations, five points should be considered: First, simplicity; second, practicability; third, painlessness; fourth, convenience; fifth, cleanliness. That which is practicable, so far as the mechanism is concerned, may be extremely inconvenient, if not painful. For various operations, including this, Magitot mentions in his work the use of hard rubber plates, with wooden pegs set in holes. The plate is formed so as to extend outside of the front teeth, through which at different points are daily driven more and more the wooden pegs, which impinge against and move the teeth. In place of these wooden pegs Dr. Gaines, of England, has used screws."

Page 162: "I now have much better and more convenient forms made as follows:—To each anchor clamp-band there is soldered on the lingual side a smooth staple or a hook to fix other parts to. Through or to these anchors are fixed the legs of a small U-shaped wire, threaded about one inch from the ends. This wire is bent to lie close to the gum alongside the lingual walls of the bicuspids. There are various other ways this might be attained, but they are objectionable.

"When this apparatus is ready for use and the anchor clamp-bands are in position, the teeth to be moved may be attached by a front bar, or better, by a small individual band, placed around each tooth, and connected independently with the front part of the *U* drag-wire by a string or wire. They may also be connected by small flat-rolled wire, by hook, ferrule or solder. The legs of the *U* wire are passed through the smooth anchor staples and held in place by hooded nuts, as shown here, or by ferrules."

Page 165: *"Outside Apparatus for Drawing in Protruding Teeth.*—The outside apparatus for drawing in front teeth consists of two clamp-bands for anchorages fitted around the posterior teeth, to which is attached, by a screw, a long band extending from one anchorage-band around the front of the arch to the opposite anchor-band."

Page 405: *"Caution to Be Observed in Correcting Protruding Front Teeth.*—The correction of deformity caused by abnormal protrusion of the six upper front teeth, however, requires a greater degree of anchorage than the posterior teeth afford, thus requiring great judgment and care; for, as the con-

dition of the alveolar process varies at different ages and in different people of the same age, it necessarily follows that the value of posterior teeth as anchorage must also vary. In other words, the anchorage resistance of teeth has a limit inside of which oral apparatus may be used with great success; outside of which, caution, at least is necessary. This limit, however, depends somewhat upon the point of attachment of the apparatus; for, when the draught is made from the necks of the teeth, the degree of anchorage resistance is greater than when from near the grinding surfaces; as in the latter position the crown acts as a lever upon the socket tissues.

"Fig. 18 is an outside view of Farrar's bridle apparatus for correcting deformities caused by protruding front teeth.

"According to my experience the degree of anchorage resistance of bicuspids and molars may be approximately stated as follows:

"Relative Anchorage Resistance of Teeth.

"1st. The anchorage resistance of two bicuspids is sufficient to move one cuspid; but as the resistance of both is nearly equal, they are equally affected,

Fig. 18.—Head gear as used by Farrar in 1886.

and in approaching each other by means of a clamp-band will meet about half way.

"2d. The anchorage resistance of one molar is sufficient to move the first bicuspid into the place of a missing second bicuspid.

"3d. The anchorage resistance of one bicuspid and one molar is sufficient to move one cuspid and one lateral incisor.

4th. Assuming that the first bicuspid is extracted to make room, the anchorage resistance of the second bicuspid and two molars (fully developed) is generally sufficient to move the cuspid back against the second bicuspid, and is sufficient afterward to draw back the contiguous incisor and one central about one-eighth of an inch, sometimes more; but this can not be relied upon.

"By the above it will be seen that, in order to correct the deformities under consideration by means of inside apparatus, the operation should not be commenced until the patient is about the age of twelve or thirteen years; for

at an earlier age the anchorage resistance is liable to be insufficient, and these posterior teeth will be liable to move forward and meet the front teeth moving in the opposite direction before they have reached the desired position, thus rendering the completion of the operation with apparatus depending solely upon bicuspids and molars for anchorage difficult if not impossible.

"Should the anchor teeth, through carelessness, or lack of experience, be tilted or moved forward too much, the further use of such teeth for anchorage should be postponed for several months, perhaps a year, when they will generally become sufficiently reset to complete the operation, if conducted with care. Instead of postponement, I prefer, however, to make such cases exceptions to the rule and push the operation on to completion by the aid of the same apparatus modified, making the back of the head the place of anchorage, and using the portion on the posterior teeth as a retaining fixture only, as illustrated by Fig. 18.

"By this apparatus (which I shall presently explain) the advancement so far made by the teeth may be retained, as the case progresses, by taking up

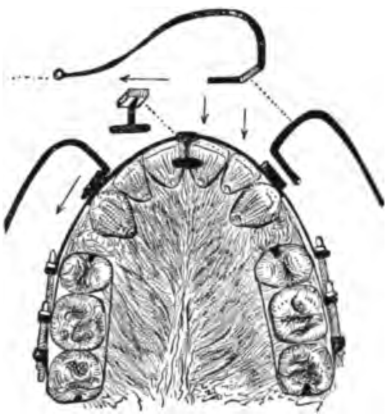

Fig. 19.—Inside view of Farrar's "Bridle apparatus" (1886).

the slack in the inside apparatus from day to day, thus insuring the case against accidents such as would occur should the outside portion of the apparatus slip off or get out of order. This combination also permits the safe removal of the outside portion and the temporary suspension of the operation during school hours.

"Bridle Apparatus for Correcting Protruding Front Teeth.—P. 409: The details of construction of this apparatus are as follows: A gold strap made of rolled wire, having a smooth nut on each end, is bent to conform with the anterior surfaces of the four or six front teeth, and fastened by means of screws to clamp-bands on the posterior teeth, as shown in Fig. 19. To prevent this front band from slipping upward to the gum, troughs have been tried, but they collect food and injure the teeth. I use one or more *T* pieces, made to fit between the teeth, soldered to the band or to ferrules sliding on the band, as used on some of my similar band apparatus of ten years ago (see Fig. 19), or broad plate hooks. Another plan of attaining this end is by the use of a round wire resting upon the lingual surfaces of the teeth, connected in the same way to the

front band. The nearer the cutting edges of the teeth these front wires rest, the less power it requires to move the teeth.

"The front band is connected with the outside apparatus by means of cylindrical or angular ferrules or staples soldered to it at points opposite the space between the laterals and cuspids. Through these ferrules or staples, which are at a sufficient distance from the corners of the mouth to prevent drooling, are hooked bent cheek-wires, *C, C, C,* (about No. 12), which project forward and outward, thence pointing toward the ears on a line with the front band (Fig. 19). To prevent the falling over of this curved cheek-wire one side of the ferrule portion may be filed flat, and the ferrule shaped to correspond by a blow of the hammer; but this is seldom necessary.

"When the apparatus is in position the friends of the patient are instructed to tighten the posterior bands or to turn the nuts within the smaller rings daily. The patient is advised to call at the office once or twice per week, when, if the position of the teeth has changed sufficiently to render the front band liable to slip off, the direction of the draught should be changed by raising the nut-ring from a lower hook on the ear-ring to one higher.

"Since devising this apparatus I have been able to regulate protruding front teeth in all cases, before as well as after the development of the second molar; and if it is made properly and delicately it operates easily, accurately, and is neither uncomfortable nor very unsightly.

"This apparatus resembles somewhat a fixture described by Dr. Kingsley, but differs widely in the object, philosophy of construction, and the character of force. The latter has for its object to depress protruding teeth in their sockets; the former to move teeth posteriorly. One is constructed with a leather skull cap and elastics for continued force on a line from the cutting edges of the front teeth to the crown of the head, or nearly in line of the long axis of the teeth; the other is a skeleton bridle constructed of woven inelastic material, connected with the teeth by means of screws, for the purpose of intermittent pressure on a line at right angles with the long axis of the front teeth, directed towards the back portion of the head.

"My methods of retaining such teeth in their new position consists in fastening gold wire into cavities in the bicuspids and molars with amalgam, as shown. As amalgam hardens slowly, the wires should first be set with phosphate of zinc, replacing only one or two plugs with the amalgam at each subsequent sitting until all are changed."

Before the section of Dental and Oral Surgery, at the Ninth International Medical Congress in a discussion of the paper of E. H. Angle, after reviewing informally, at considerable length, the papers on *Etiology of the Teeth,* J. N. Farrar spoke concerning the reason for correcting irregularities of the teeth by intermittent force:

"To differentiate more clearly, I will reiterate in brief that, while the old plans of constructing regulating apparatus only recognized one thing as essential, force, a view based upon the belief that 'force is force,' no matter of what character or as one essayist puts it, 'it matters little whether the pressure be continuous or intermittent, since the results are the same,'—implying that the

results are the same, and not even taking into account the almost necessary concomitant of such devices, filthiness,—I claim that the character of force can govern the question of pain, that the tissues will always painlessly tolerate a proper degree of intermittent force if not too frequently repeated, and that any cleanly mechanical apparatus which can be controlled at will so as to attain these ends, when based upon and operated with these functions in view, embodies the main principles of a system that I consider the most scientific.

"This being my opinion, it goes without saying that regulating apparatus constructed substantially as here shown by the essayist preceding me, must be, in the main, in accordance with my views; but when the essayist attempts to assert that this is a new system of regulation and retention, I think he is assuming that which can not be accepted by readers of the dental journals. So far as the mechanical devices are concerned, it would be easy to mention the journals which contain descriptions and illustrations, substantially, of every one of them. But this is not the time or place to do so; indeed, it is unnecessary, as they must already be familiar to all.

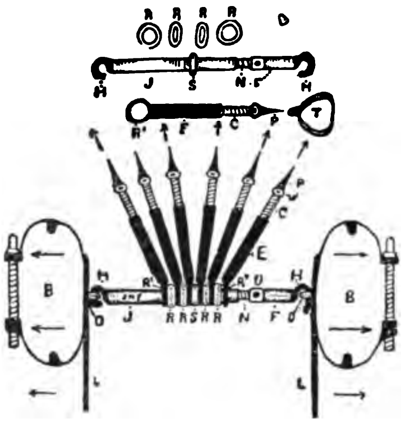

Fig. 20.—Machine for enlarging the upper dental arch (1887).

"Mechanisms for regulating teeth are now numbered by the hundred; some are simple, others complicated; both kinds are equally valuable in their place. Of the many fixtures that I have devised and published from time to time, probably the simplest is a metallic clamp-band made of a ribbon of rolled gold wire, on each end of which is soldered a nut, which in turn are connected by a screw.

"The clamp-bands as well as the splice-bands may be prevented from working down upon the gum by having ears made upon them to rest in the sulci of the teeth, or by gum guard-rings having lugs for the bands to rest on.

"Clamp-bands are excellent anchorages for jackscrews, which may be made to push or to draw teeth in nearly every direction. This combination may be simple or complex, depending upon the number of parts and pieces used.

"The more complicated fixtures in connection with the clamp-bands I generally improvise from various elementary devices selected from what I denominate the 'universal set.' This consists of different sizes of anchor-bands, push-

jacks, *E;* draw-jacks, anchor-jacks, *J;* rings, *R, T*'s, *N;* ferrules, *T,* etc., samples of the most of which are represented in Fig. 20.

"To return to our case, the upper jaw received the principal share of the attention, the lower teeth being reduced only sufficient to better fit the needs of the upper arch when it should be properly enlarged. While the upper jaw was too small to be in proportion with the other parts of the face, the lower jaw was not, and only required slight alteration. The lower arch was somewhat crowded in the region of the cuspid teeth, which were inclined forward, lapping and partially hiding the front of the lateral incisors. The bicuspids also had not sufficiently erupted to be on a plane with the antagonizing surface of the others. To regulate the lower arch one of the bicuspids on each side was extracted, and the cuspids drawn back by means of gold clamp-bands extending around the molar teeth for anchorage; the bands being operated by screws and a key.

"The third and main step, the spreading of the upper arch, the most interesting portion of the operation in the case of this patient, was successfully ac-

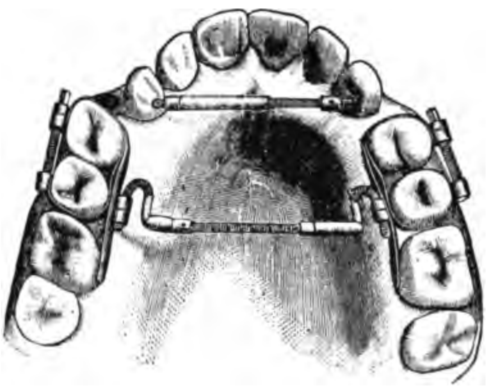

Fig. 21.—Appliance used by Farrar (1887) and described before the Ninth International Medical Congress.

complished in stages, intermitted by periods of rest. The first step of the operation upon the upper jaw was the partial outward movement of the bicuspids and the first molars. The apparatus consisted of a system of jack-screws capable, when used entire, of acting at the same time, as shown in Fig. 22.

"Only a part of the device, however, was applied at first; this consisted of a double-yoke jackscrew with a bar extending against the first molars, which was firmly bound to the bicuspids by means of screws and nuts as shown.

"The use of this portion of the apparatus was to force outwards these six side teeth. At this stage a cylindrical spindle screw-jack was placed across the arch for the purpose of forcing the cuspids directly outward before being carried forward.

"Fig. 21 represents the appearance of the upper jaw at this time, with the six side teeth nearly in position. These instruments had, in eleven weeks, carried the side teeth sufficiently outward to be directly over the lower arch. At this point the masticating functions of the teeth being perfect, these appliances were exchanged for a simple hard rubber plate, and the treatment suspended

for several months, for rest. The cuspids and four incisors required to be forced radially forward, over, and in advance of the under teeth.

"The retaining plate was finally removed and the jackscrew reinserted to hold the four bicuspids and two first molars in position, and to serve as a foundation to support the other portion of the compound system of jackscrews, for the purpose of forcing outward the six front teeth. Fig. 12 shows the appearance of the case at the completion of the operation and before the apparatus was removed."

In 1888 Farrar published the first volume of *A Treatise on the Irregularities of the Teeth and Their Correction* containing 757 pages and 695 illustrations. This volume was based upon the articles already reviewed and therefore will not be taken up in greater detail. Under Chapter XLVI and XLVII, pages 487-498, *Antagonism of the Teeth, Theoretical and Actual—Different Kinds of Occlusion,* the following will, no doubt, be of interest to the readers of this historical review:—

"The division of the dental arch into sections, constituting what are denominated teeth, together with the peridental pocket (cushion), in which each of them rests, allows greater elasticity of movement than would be the case if all the teeth were massed into one. This independence of action not only renders them less liable to wear away, but also enables them to move about by the antagonism of their inclined surfaces until they fit themselves to each other. If one section becomes disabled, so that it is necessary to extract it, the remainder are held comparatively undisturbed. The theory of this independent movement of the teeth in most cases is proven by the worn and highly polished facets that are plainly noticeable on the approximate surfaces of teeth in aboriginal skulls, which can be seen in museums.

"In the art of correcting irregularities, a perfect understanding of antagonism, and of the influence of lateral pressure of adjacent teeth, is still more important to insure the permanence of the new relations after correction; for it should be remembered that success in regulating teeth depends not only upon adjusting them so that they will have sufficient room to stand freely, but also upon holding them in place by the interlocking of some of the cusps. Indeed, without this knowledge, no one should expect permanent success in his operations. In some cases, it is even more difficult to fix the teeth so that they will remain in their new positions than it is to move them into line.

"There are, however, some aspects of this question that should be observed; for instance, if the line of continuity of the arch is broken by the loss of some of the teeth, and some of the remaining teeth antagonize obliquely, a greater or less number, adjacent to the gap, will probably move away from their neighbors along the open territory; or, if the obliquity is in the opposite direction, toward a portion of the mouth which is already overcrowded, not only may the deformity become more striking, but, at the points of contact, necrosis of the enamel may occur. In such cases, the enamel in time breaks down in decay. Thus it will be seen that the locking of teeth has its advantages as well as disadvantages."

"*Perfection Not Attainable.*—Perfect antagonism, such as is found in the highest order of human development, is a condition that can not be attained in

all cases, but must be regarded rather as a point to be aimed at and reached so far as practicable. An attempt to secure more would not only be found impracticable in many cases, but (if possible) it might also be at the sacrifice of esthetic results. To reiterate, although, theoretically, perfection of antagonism is desirable, it is in practice not only often impossible to attain, but in some cases it would also be injudicious to attempt it, as it might increase facial deformity.

"In cases where the upper alveolar ridge is too small to accommodate the teeth, which are consequently overcrowded and jumbled, while at the same time the jaw and upper part of the face correspond in size with the lower, it is evident that if we proceed to enlarge the upper arch sufficiently to accommodate all the teeth in line, we would not only destroy the antagonism, but would also cause, as has been implied, protrusion of the lips. To avoid this result, extraction of one or more teeth is the only alternative, in order to bring about the arrangement which best combines usefulness with improvement of the face. In some cases, antagonism should be regarded as second in importance. That is to say, the aim of the operator should be to reach the highest

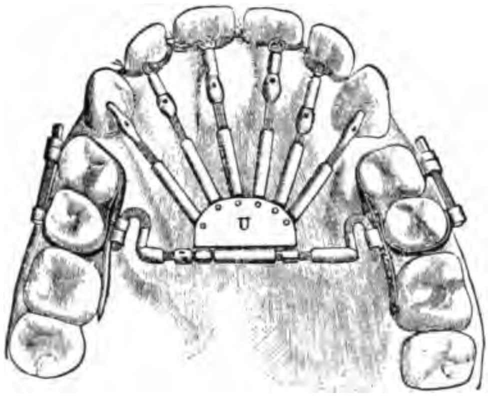

Fig. 22.—Appliance used by Farrar (1887) and described before the Ninth International Medical Congress.

possibilities, taking all things into consideration. To avoid deforming the face, while securing the best antagonism possible under the circumstances, is more desirable than to gain antagonism by the sacrifice of appearance. Let us try to increase usefulness by improving antagonism and mastication as far as possible, but let us not, in order to effect these, permit the faces of our patients to assume the appearance of apes."

In 1895 before the Odontological Society of New York, Farrar, in discussing a paper read by Calvin S. Case on the *Bodily Movement of Teeth*, published in the *Transactions of the Odontological Society*, page 69, replied:—

"This society should congratulate itself upon having such an interesting presentation of this subject as the essayist has given us this evening. Now, to his question, do we 'believe that the bones around about the roots of the teeth were bent?' I will say I think they were; but just how far they were bent, or just what and where all the parts were altered, of course can only be inferred from the outward appearances. If we could take the flesh off the bones before

the operation, and then take a cast of the bone, then return the flesh, regulate the teeth, and then take another cast, we could prove the facts; but at present we must be content with reasoning upon the subject. That the bones under the lower part of the nose can be bent by applying force to the incisors I have had proof of in some of my operations. Let me tell how I first caught upon the fact. Several years ago (1886 and 1887) I had occasion to regulate a case of protruding upper teeth for a young lady about fourteen years of age; the lower part of her lower lip was somewhat prominent but the upper part was not as full as it should have been. I drew the lateral incisors posteriorly (after having caused the cuspids to naturally move into the places of the extracted first bicuspids) by a gold skeleton mechanism anchored to the posterior teeth, and when these teeth were in their proper places (against the cuspids) the same mechanism was applied to the centrals; but the anchorage resistance was not sufficient to move them far without moving the posterior teeth forward, therefore I was obliged to resort to the skullcap or headgear, a sort of harness, having gold draught wires connecting it with the ends of the crowns of the incisors. By retightening this harness these teeth (crowns) moved posteriorly, in the same way as other dentists have noticed in their operations; but now comes the point intended by mentioning this case. One day the father called on me and said, 'Myself and wife have concluded to take our family to Europe; now, how soon can you push my daughter's case through?' He also told me when he would like to sail. I replied, 'It can only be hurried by increasing the force, and perhaps the case will not permit of great increase without causing too much pain; but I will immediately begin the trial.' The draught upon the teeth was increased gradually, and in a few days it was carried to a point that caused the head to ache slightly. Shifting lower a part of the anchorage so as to include the base of the occipital region, the full force was maintained. During all this time however, the patient said that she noticed no pain about the teeth, but incidentally remarked that there was a peculiar feeling just under the nose. This, however, made no impression on my mind, as I had often heard similar remarks from other patients under similar operations.

"We were now applying all the force that the harness would permit without causing headache, and the teeth were moving gradually,—but not as rapidly as the parents desired. To my surprise, however, the father and daughter called one evening about ten o'clock, and said, 'My daughter's teeth are now moved in far enough.' I examined the case, and sure enough the teeth had moved more rapidly than I ever knew teeth to move before, and had reached their proper places. But what had caused the sudden change seemed mysterious until I examined the contour of the entire lip and nose, and found that the same changes had taken place that Dr. Case's casts present. The upper part of the lip was now filled out, and the end of the nose was slightly advanced.

"It was plain to be seen that the drawing upon the ends of the crowns had thrown the roots forward, and that this was the cause of the outward changes in the lip and nose; but whether the suture between the halves of the upper jawbone had yielded and the borders of the bone turned outward, or whether sufficient decalcification had taken place in the bone to enable it to bend by the leverage of the teeth upon it, I could not determine; but one thing was certain,

great changes had taken place in its contour and the roots of the teeth had moved forward *en masse* by tilting on fulcrums at the necks.

"This was a lesson that led me to an idea of the possibilities of such operations, and I immediately determined to work upon this line with improved mechanisms. I now have some half dozen, all based upon philosophical laws. I have brought with me several engravings of these, taken from my forthcoming volume, which I will pass around after I have sketched them upon the blackboard, so as to explain their action. I wish to say, however, before I proceed, that I regard Dr. Case's mechanism not only simple but philosophical; that it is practicable he has proven by his results. Mine differs from his, and, therefore, the combination of his mechanism belongs to him.

"As you will finally see, the engine of force in all my mechanisms for moving roots forward is placed within the dental arch, represented by this sketch (Fig. 23) the base of support is a transpalatine screw-jack, anchored by two clamp-bands, that embraces the side teeth; from this jack to the posterior sides of the neck of the incisors, and lying close to the sides of the arch, are two other screw-jacks to press against these front teeth; to hold these jacks upon them, each incisor has upon it a broad ferrule (cemented), with a U-shape lug on the lingual side, near the gum (see *F* in lower part of Fig. 23), in which a bar connecting the anterior ends of the jacks rests. To hold firmly the ends of the crowns of the incisors, and prevent them from moving forward when these jacks are set at work against the necks of the teeth they (the ends) are tied to the transpalatine jack by two wire cords, connecting with a cross-bar lodged in other U-shape lugs soldered to the labial side of the ferrules, near the ends of the teeth, as represented by this sketch. (Fig. 24.)

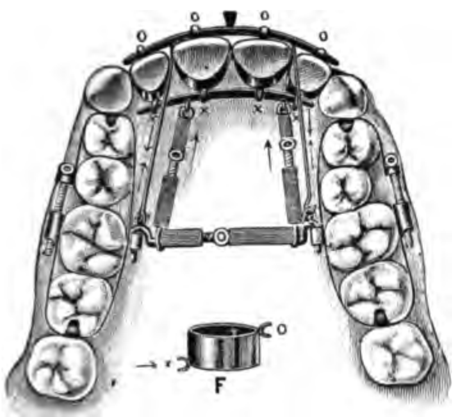

Fig. 23.—Mechanism for moving the roots forward en masse (1895).

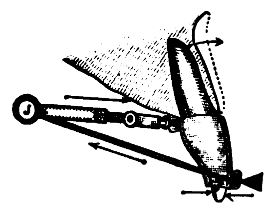

Fig. 24.—Showing the principle of applying compensating force (1895).

"In another mechanism I use more radial screw-jacks than in this one, for forcing the roots forward; these are arranged thus (see Fig. 20). The ends of the crowns are held fixed by a wire bow placed in U-lugs, one being hooked into a wire ring soldered to the lingual side of the anchor-bands, and

the other screwed to the corresponding side of the other band. It is a modification of my screw long band.

"As will be seen, all these mechanisms are for moving forward the roots of the front teeth where the upper part of the upper lip is sunken; but for moving the roots posteriorly, as needed in cases where the upper part of the lip is too prominent, they would not be practicable without some modifications being made in them; these modifications can be made easily. This mechanism, like all the others that I have described, acts compensatingly, one force upon the anchorage being balanced by the others.

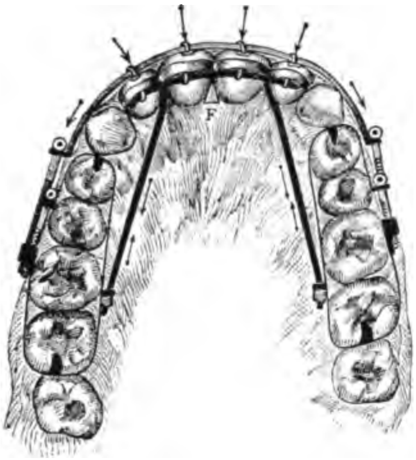

Fig. 25.—Mechanism for moving posteriorly the roots of upper incisors (1895).

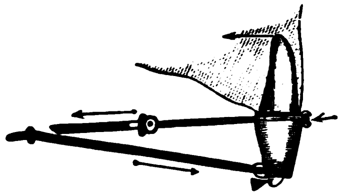

Fig. 26.—Showing the philosophy of the use of the brace and long band (1895).

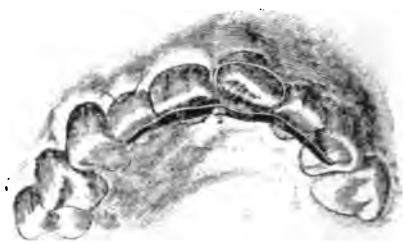

Fig. 28.—Metallic slip noose rotating fixture.

Fig. 27.—Appliance found in Farrar's Vol. II. (1877).

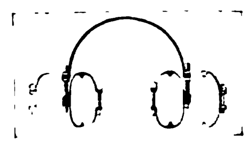

Fig. 29.—Adjustable clamp bands and arch as described by Farrar (1879).

"The above sketch (Fig. 25) represents a mechanism designed for this purpose, and it is very similar to several that I published many years ago. The crowns are stayed by an inside rectangular frame resting in U-shaped lugs at the ends of the crowns, and braced against nuts soldered to two anchor-clamp bands on the side teeth; the roots are drawn back by what I call a screw-acting long band resting across the labial sides of the necks of the teeth to be acted upon and attached to the clamp bands by screws." (Fig. 26.)

In 1897 Farrar brought out his second volume of *Treatise of Irregularities*

and Their Correction, a volume as large as his first one. Among the appliances devised by him is the one shown in Fig. 27 and represents "an elaborate gold mechanism, devised mainly for moving the cuspid a short distance away from the central and lateral, and not for any other part of the operation. It consists of anchors, a hinged wing-piece, three screws, three pins, and a small screw-jack. The anchors consisted of two ferrules and two thumbscrews. To the anterior parts of the anchors were soldered two rigid bows, a lingual and a labial.

"To the posterior parts of the ferrules were soldered two rigid wire loops. These extended posteriorly and embraced the molars. The thumbscrews were for tightening the rear parts of the loops upon these molars. The two screws on the patient's right were for moving the lateral toward the right central.

"In order to make this screw bear sufficiently high upon the wing and under the lip of the gum, it was necessary to project it (the screw) through a place in the gum (made by a lance) between the central and lateral. To prevent the screw from irritating this gum-tissue, the threads on the wing extremity of it were filed away, leaving it smooth for about one-eighth of an inch from the end."

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EDITORIALS

The Weakness of the Gingival Margin

WHEN we stop to consider the almost universal prevalence of gingival infection among people of middle age, we are forced to stop and wonder why this condition is so common. The principal reason for infection of the gingival tissue lies in the fact that we have a condition existing around the gingival margin of the tooth that does not exist anywhere else in the body. In the formation and development of the tooth, Nature was forced to permit a weakness from the standpoint of construction, which she was able to prevent everywhere else. The weakness of the gingival tissue exists in the fact that there is a break in the epithelial covering of the oral cavity at the gingival margin of the tooth; hence, as a result of this break in the epithelial covering, the connective tissue is exposed to infection in a manner not found in

any other part of the body. During the process of development of the enamel which is a structure derived from epithelium, we find the enamel finally becomes completely calcified in such a manner that the remaining epithelial tissue can not become physiologically attached to the enamel. Consequently a break in the epithelial tissue between the enamel of the tooth and the epithelial lining of the mouth occurs at the gingival margin.

Nature has attempted to remedy this defect by shaping the gingival marginal ridge of the crown of the tooth and by developing the fibers of the peridental membrane, which hold the soft tissue, supporting the epithelial lining of the oral cavity, up against the gingival marginal ridge of the tooth, in such a manner as to mechanically prevent infection or prevent anything from crowding in between the enamel of the tooth and the epithelial lining of the mouth. When we stop to consider the normal disadvantage which Nature is working against in this region, we must admit that the result is highly satisfactory considering the difficulties she has to encounter. In normally shaped teeth, with normal gingival marginal ridges, and teeth properly placed with normal proximal contact points, we find that the peridental membrane, supporting the soft tissue, holds the epithelial lining up around the enamel of the tooth, in such a manner as to make a very effective stoppage between the epithelial tissue and the enamel and thereby prevent infection of the underlying connective tissue.

However, if as a result of malocclusion, the gingival marginal ridge of a tooth and the proximal contact points are not properly placed, this mechanical stoppage between the gingival marginal ridge and the epithelial lining of the mouth is faulty, and infection of the underlying connective tissue is more liable to occur. It must also be remembered that any mechanical device which interferes with the epithelial tissue and its contact with the gingival margin of the tooth is going to expose the connective tissue to infection. The weakness of the gingival margin of the tooth must be recognized and everything must be done to assist in giving the same protection that has been given other parts of the body.

Permanent Staff Appointments for the Forsyth Dental Infirmary for Children

A COMPETITIVE examination of graduates in dentistry (of less than three years standing) for appointments to positions on the permanent staff for full and one-half time service will be held early in June at the Infirmary.

Appointments will be made for one or two years as follows:

Full time service requiring operating five and one-half days a week at a salary of $1000 a year.

One-half time service requiring operating six half-days a week, either forenoon or afternoon, at a salary of $400 a year.

These appointments will be made subject to satisfying the requirements of

the Massachusetts State Board of Registration in Dentistry and to "qualifying" in the practical work of the clinics during one month's trial.

Members of this staff will be entitled to the advantages of reports and clinics by experts in the various branches of dentistry from different parts of the world in addition to the numerous regular clinics and lectures.

Operators after serving four months are eligible, by qualifying, for appointments in the special clinics where postgraduate work is given.

The operators on this staff have the advantage of the clinics and lectures of the Postgraduate School of Orthodontia.

The infirmary clinics provide unusual advantages in the various departments of the institution where operative dentistry, orthodontia, nose and throat and oral surgery, extracting, novocaine technic, radiography, pathological diagnosis and research work are continually carried on.

The average number of cases treated daily is more than 450 in all departments.

All material and necessary operating instruments will be furnished; up-to-date apparatus including electric engines, sterile instrument trays, fountain cuspidors, compressed air, and the modern operating-room-type of lavatories are available for use.

A diploma for service will be issued by the trustees to each member of this staff who has completed this term of service in a satisfactory manner.

Applications for the above positions should be made not later than May 18.

Information and the date of the examination will be furnished to those interested by Harold DeW. Cross, D.M.D., Director, 140 The Fenway, Boston, Mass.

The Public Press in Dentistry

WITH the realization of the importance of focal infections by the medical profession, the need of educating the public in regard to the care of the teeth has become a question of vital importance. Suggestions for the promulgation of this knowledge have been made by a great number of men during the last few years. None of the plans so far suggested are entirely satisfactory, but all are capable of accomplishing some good purpose. The public press has been advocated as a medium.

We realize that there is no other means of education that has as much influence as the public newspaper; however, it must be remembered that anything having such a widespread influence as the public press must be carefully handled, or it will become a detriment as well as a benefit.

As an example of the injury that publication can do a subject, we need only look at the widespread publicity that is given emetine in the treatment of pyorrhea. Articles by medical men and by lay writers appeared in various newspapers and magazines heralding emetine as a cure for pyorrhea. People obtained their knowledge of the treatment of pyorrhea from the public

press, and as a result of this, dentists had patients coming to them with clippings from newspapers, demanding that treatment be given them in their case. As another example of unwise publicity we call attention to that given "606" some years ago. These cases are cited simply to show that information through the public press, unless entirely reliable, may not be information that is desirable. In the majority of instances articles that have been published in the press dealing with the care of the teeth have produced more good than harm; nevertheless, if articles were more carefully edited and were written by some one better versed in dentistry, they would accomplish much more than they do.

Only recently in a paper which contains a health column conducted by a very prominent medical man there appeared an article entitled "The Care of the Teeth," in which was cited a paper dealing with dentistry as an economic factor in a large manufacturing plant. On the whole the article was very good, and was one which undoubtedly attracted considerable attention and comment. However, there was one grave mistake made. The statement was made that "the permanent teeth do not begin coming through the gums until the child is seven years of age." If this statement is taken literally, as it will be by a great many people, it eliminates entirely the time of eruption of the first permanent molars which make their appearance before the age of seven, and which often require dental attention before that period. A great many mothers take the first permanent molar for a deciduous tooth because it erupts without the loss of any of the deciduous teeth, and this idea is permitted to exist by the statement of the medical man that the permanent teeth do not erupt before the age of seven. We can imagine a great many mothers making the statement that they thought the permanent molar was a deciduous tooth because they had read in the newspaper that permanent teeth did not erupt before the age of seven. We will admit that this particular statement does not entirely ruin the article, but we believe that, had it been more carefully edited, it would have accomplished more good, and would not have been the possible source of misunderstanding that it is, appearing in the present condition.

We recognize the importance of the public press as a means of giving knowledge on dental subjects; but articles would accomplish more if edited by a dental hygiene committee or someone entirely familiar with the subject than if written by a layman or by a medical man who has gleaned his knowledge of dentistry by hearsay and reading.

The Duty of the Employer in the Reconstruction of the Crippled Soldier

WE must count on the return from the front of thousands of crippled soldiers. We must plan to give them on their return the best possible chance for the future.

Dependence cannot be placed on monetary compensation in the form of a pension, for in the past the pension system has proved a distinct failure in so far as constructive ends are involved. The pension has never been enough

to support in decency the average disabled soldier, but it has been just large enough to act as an incentive to idleness and semi-dependence on relatives or friends.

The only compensation of real value for physical disability is rehabilitation for self-support. Make a man again capable of earning his own living and the chief burden of his handicap drops away. Occupation is, further, the only means for making him happy and contented.

Soon after the outbreak of hostilities the European countries began the establishment of vocational training schools for the rehabilitation of disabled soldiers. They had both the humanitarian aim of restoring crippled men to the greatest possible degree and the economic aim of sparing the community the burden of unproductivity on the part of thousands of its best citizens. The movement had its inception with Mayor Edouard Herriot of the city of Lyons, France, who found it difficult to reconcile the desperate need for labor in the factories and munition works while men who had lost an arm or a leg but were otherwise strong and well were idling their time in the public squares. He therefore induced the municipal council to open an industrial school for war cripples which has proved the example and inspiration for hundreds of similar schools since founded throughout France, Italy, Germany, Great Britain and Canada.

The disability of some crippled soldiers is no bar to returning to their former trade, but the injuries of many disqualify them from pursuing again their past occupation. The schools of training prepare these men for some work in which their physical handicap will not materially interfere with their production.

The education of the adult is made up largely of his working experience. The groundwork of training in his past occupation must under no circumstances be abandoned. The new trade must be related to the former one or be, perhaps, an extension or specialization of it. For example, a man who had done manual work in the building trades may by instruction in architectural drafting and the interpretation of plans be fitted for a foreman's job, in which the lack of an arm would not prove of serious handicap. A trainman who had lost a leg might wisely be prepared as a telegrapher, so that he could go back to railroad work, with the practice of which he is already familiar.

Whatever training is given must be thorough, for an adult can not be sent out to employment on the same basis as a boy apprentice. He must be adequately prepared for the work he is to undertake.

The one-armed soldier is equipped with working appliances which have supplanted the old familiar artificial limb. The new appliances are designed with a practical aim only in view; they vary according to the trade in which the individual is to engage. For example, the appliance for a machinist would be quite different from that with which a wood turner would be provided. Some appliances have attached to the stump a chuck in which various tools or hooks can interchangeably be held. The wearer uses these devices only while at work; for evenings and holidays he is provided with a "dress arm" which is made in imitation of the lost natural member.

An important factor in the success of re-educational work is an early start, so that the disabled man shall have no chance to go out unemployed into the community. In even a short period of exposure to the sentimental sympathy of family and friends, his "will to work" is so broken down that it becomes difficult again to restore him to a stand of independence and ambition. For this reason, therefore, the plan for his future is made at as early a date as his physical condition admits, and training is actually under way before the patient is out of the hospital.

In the readjustment of the crippled soldier to civilian life, his placement in employment is a matter of the greatest moment. In this field the employer has a very definite responsibility.

But the employer's duty is not entirely obvious. It is, on the contrary, almost diametrically opposite to what one might superficially infer it to be. The duty is not to "take care of" from patriotic motives, a given number of disabled men, finding for them any odd jobs which are available, and putting the ex-soldiers in them without much regard to whether they can earn the wages paid or not.

Yet this method is all too common. A local committee of employers will deliberate about as follows: "Here are a dozen crippled soldiers for whom we must find jobs. Jones, you have a large factory; you should be able to take care of six of them. Brown, can you not find places for four of them in your warehouse? And Smith, you ought to place at least a couple in your store."

Such a procedure can not have other than pernicious results. In the first years of war the spirit of patriotism runs high, but experience has shown that men placed on this basis alone find themselves out of a job after the war has been over several years, or in fact, after it has been in progress for a considerable period of time.

A second weakness in this method is that a man who is patronized by giving him a charity job, comes to expect as a right such semi-gratuitous support. Such a situation breaks down rather than builds up character, and makes the man progressively a weaker rather than a stronger member of the community. We must not do our returned men such injury.

The third difficulty is that such a system does not take into account the man's future. Casual placement means employment either in a makeshift job as watchman or elevator operator such as we should certainly not offer our disabled men except as a last resort—or in a job beyond the man, one in which, on the cold-blooded considerations of product and wages, he can not hold his own. Jobs of the first type have for the worker a future of monotony and discouragement. Jobs of the second type are frequently disastrous, for in them a man, instead of becoming steadily more competent and building up confidence in himself, stands still as regards improvement and loses confidence every day. When he is dropped or goes to some other employment, the job will have had for him no permanent benefit.

Twelve men sent to twelve jobs may all be seriously misplaced, while the same twelve placed with thought and wisdom and differently assigned to the same twelve jobs may be ideally located. If normal workers require expert

and careful placement, crippled candidates for employment require it even more.

The positive aspect of the employer's duty is to find for the disabled man a constructive job which he can hold on the basis of competency alone. In such a job he can be self-respecting, be happy, and look forward to a future. This is the definite patriotic duty. It is not so easy of execution as telling a superintendent to take care of four men, but there is infinitely more satisfaction to the employer in the results, and infinitely greater advantage to the employee. And it is entirely practical, even in dealing with seriously disabled men.

A cripple is only debarred by his disability from performing certain operations. In the operations which he can perform, the disabled man will be just as efficient as his non-handicapped colleague, or more so. In the multiplicity of modern industrial processes it is entirely possible to find jobs not requiring the operations from which any given type of cripples are debarred. For such jobs as they can fill the cripple should be given preference.

Thousands of cripples are now holding important jobs in the industrial world. But they are men of exceptional character and initiative and have, in general, made their way in spite of employers rather than because of them. Too many employers are ready to give the cripple alms, but not willing to expend the thought necessary to place him in a suitable job. This attitude has helped to make many cripples dependent. With our new responsibilities to the men disabled in fighting for us, the point of view must certainly be changed. What some cripples have done, other cripples can do—if only given an even chance.

The industrial cripple should be considered as well as the military cripple, for in these days of national demand for the greatest possible output there should not be left idle any men who can be made into productive workers.

With thoughtful placement effort, many men can be employed directly on the basis of their past experience. With the disabled soldiers who profit by the training facilities the government will provide, the task should be even easier.

This, then, constitutes the charge of patriotic duty upon the employer:

To study the jobs under his jurisdiction to determine what ones might be satisfactorily held by cripples. To give the cripples preference for these jobs. To consider thoughtfully the applications of disabled men for employment, bearing in mind the importance of utilizing to as great an extent as possible labor which would otherwise be unproductive. To do the returned soldier the honor of offering him real employment, rather than proffering him the ignominy of a charity job.

If the employer will do this, it will be a great factor in making the complete elimination of the dependent cripple a real and inspiring possibility.

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ORIGINAL ARTICLES

THE MECHANISM OF WIRE STRETCHING

BY MARTIN DEWEY, D.D.S., M.D., CHICAGO, ILL.

IN the November, 1917, issue of the JOURNAL there appeared an editorial entitled, "A Word of Caution in Regard to the Use of the Wire-stretching Pliers." I am so impressed with the possibilities of this instrument for good or for harm, that I wish to use the following diagrams in further explanation.

In the editorial attention was called to three facts; namely, that the beaks of the pliers must be of the proper shape, the material must possess the proper physical characteristics, and the pinch must be made with a knowledge of the various results to be obtained by a movement of the handle of the pliers. It was also stated that the beaks must be parallel at the finish of the pinch. Attention was also called to the fact that a wire-stretching pliers that has been designed or shaped to pinch one gauge of wire must not be used on another gauge; for example, if pliers the beaks of which are shaped to pinch a 19-gauge wire are used on an 18-gauge wire, it will be found that instead of the wire being lengthened in a straight line or without curvature, the ends of the wire will bend away from the pliers. If wire-stretching pliers designed to pinch 19-gauge wire are used on a 20-gauge wire, the ends of the wire will bend towards the handle of the pliers.

Fig. 1 shows the relation the beaks of the pliers must bear to each other at the close of the pinch. If the beaks are parallel cylinders (or cylinders of the same diameter which are parallel to each other) at the close of the pinch, the wire will be lengthened without any curvature. If the external portion of the beaks of the pliers close more nearly together than the internal portion, the ends of the wire will be turned toward the handle as shown in Fig. 2. In Fig. 2, *A* represents a piece of straight wire before the beginning of the pinch with pliers the beaks of which resemble the general outline shown in Fig. 2. At the completion of the pinch, the straight piece of wire shown at *A* will assume the position

represented by *B*. It can readily be seen what a large amount of harm would be done to a regulating appliance if a wire was pinched with this style of pliers without the operator realizing what was taking place.

If, on the other hand, pliers are used of which the external portion of the beak does not close as tightly as the internal portion, the wire would be turned away from the pliers as illustrated in Fig. 3.

A of Fig. 3 represents the straight piece of wire before the beginning of the pinch, while *B* shows the manner in which the wire would be curved if pinched by a pliers, the beaks of which had a general relation as shown in Fig. 3. It must be remembered that the relation of the beaks of the pliers as illustrated in Figs. 2 and 3 are exaggerated, and of course, can readily be detected by the eye. In actual practice, it must be remembered, that such a small variation as can not be detected by the eye, will produce changes in the wire as illustrated in Figs. 2 and 3. It therefore becomes necessary before using a wire-stretching pliers to take a straight piece of wire and pinch it outside of the mouth and carefully observe what results have taken place.

There is probably no force used in the correction of irregularities that has as many advantages as the force obtained from the wire-stretching pliers prop-

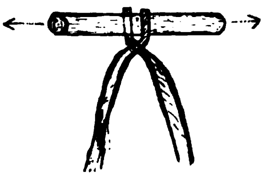

Fig. 1.

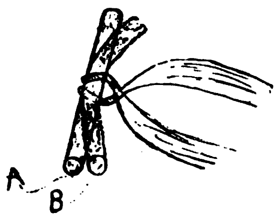

Fig. 2.

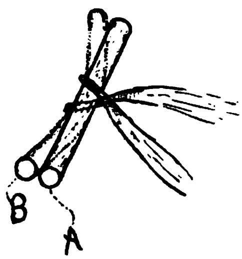

Fig. 3.

erly applied. It can equally be said that there is no force which is liable to do more harm than that obtained from the wire-stretching pliers, if their use is not understood or if the beaks of the pliers are improperly shaped, because of the fact the force is exerted so gradually that the tooth change occurs without the operator hardly realizing how these changes are occurring. We are aware of the fact that a great many men have begun using the wire-stretching pliers before they have become familiar with their mechanical action, and consequently have produced many undesirable tooth movements without being aware of how those movements occurred. I, therefore, would caution all to first be absolutely certain that the beaks of the wire-stretching pliers are so shaped as to produce a straight pinch, or rather a pinch which will lengthen the wire without bending it. Second, it must be remembered that the wire-stretching pliers adjusted to one gauge of wire can not be used on another gauge of wire. Third, it must be remembered that the wire used with the wire-stretching pliers must be one which is capable of giving an even pinch without the wire becoming brittle during the pinching.

It has been found that some of the alloys containing gold and platinum are unsuited for use with the wire-stretching pliers because these metals seem to crystallize during the pinch, which results in the wire breaking at the place where

the pinch is made. Other alloys are entirely too hard which have resulted in the breaking of the wire-stretching pliers as well as in producing a pinch that is brittle. At the present time the most satisfactory wire for use with the wire-stretching pliers is a 16 per cent iridioplatinum wire. It must also be remembered that in making a pinch on a lingual or labial arch with the wire-stretching pliers a certain tooth movement will be produced according to the place and manner in which the pinch is made.

In presenting the following diagrams, it must be remembered that they have been made to show the mechanics of the wire-stretching pliers, and the changes that occur as a result of the pinch and various manipulations of the pliers during the pinch. The force resulting from the use of the pliers is accurately shown in the diagrams, and can be proved by technical demonstration, provided both ends of the wire are held rigid during the pinch. In the use of the wire-stretching pliers on an appliance, it must be remembered that the resulting movements of the teeth will depend upon the anchorage and resistance offered by the supporting structures. Furthermore, I wish to state that all of these various movements and mechanical principles have been utilized by

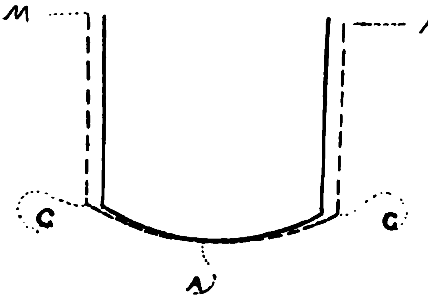

Fig. 4.

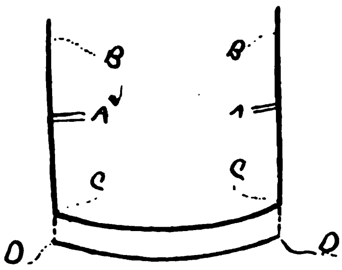

Fig. 5.

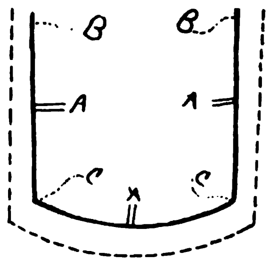

Fig. 6.

Lloyd S. Lourie and I have employed a great many. This statement is made at this time to impress upon the reader the practical application of the principles shown by the following diagrams.

The solid line drawing in Fig. 4 represents a lingual arch which is soldered to the molar band. If it is desired to produce a buccal expansion of the molar and premolar region, a pinch made in the lingual arch somewhere in the incisal portion about the region of *A* will produce a lengthening of the lingual arch from *C* to *C* which in turn will carry the lateral halves of the arch from *C* to *M* buccally. This pinch made in the incisal portion of the arch preferably near the central portion will lengthen the arch from *C* to *C* and produce the expansion as shown by the dash line in Fig. 4. If pinches are made in the canine portion of the wire, a pinch must be made on both the right and the left side to produce an equal expansion. If a pinch is made only on one side of the wire in the canine region, it will produce a change in the wire as shown in Fig. 10. In order to produce an equal expansion in both the canine and molar regions, the pinch in the incisal portion at *A* must be made with the beaks of the pliers held absolutely stationary, without a movement forward or backward or without any rotation of the handle of the pliers. It is never advisable to make more than two pinches at one sitting in the incisal portion of the arch. Care must be taken not to place

enough stress upon the wire between *C* and *C* as to produce a bend in the wire. It must remain absolutely the same except in length in order to produce an expansion in the molar region without rotating or tipping the molars. If a sufficient number of pinches are made at one sitting to strain the wire and produce a bend from *C* to *C*, the molars will be tipped or rotated in some manner.

In Fig. 4 it has been shown that if the wire-stretching pliers are placed in the incisal portion of the alignment wire between *C* and *C* and a pinch is made without moving the beaks the alignment wire will be widened in such a manner as illustrated by the dotted line.

If the alignment wire is pinched anywhere in the molar region between *B* and *C* as illustrated in Fig. 5 the premolar section of the alignment wire will be lengthened between *B* and *C* and the incisal section will be carried forward to the position represented by *D;* that is, the incisal section will be carried forward provided the molars are not moved distally. The purpose of Fig. 5 is to illustrate the possibility of lengthening the premolar section of the lateral halves of the dental arch by pinching the alignment wire in the premolar region and carrying the incisors forward without any expansion in the incisal portion.

If it is desired to expand in the molar and premolar region, and at the same time carry the incisal portion of the alignment wire forward, thereby expanding the dental arch in all regions, that tooth movement can be produced by making pinches in both the incisal and the premolar sections at points illustrated by *A* in Fig. 6. In order to produce this increase in size of the alignment wire and thereby expand the dental arch as illustrated by the dotted line in Fig. 6, the wire-stretching pliers placed at point *A* must be held stationary and not rotated or the handles moved during the time the pinch is being made. By making a pinch anywhere between *B* and *C* the lateral half of the alignment wire will be lengthened by making a similar pinch between *C* and *C* the dental arch will be expanded or the alignment wire will be lengthened in the incisal portion.

Realizing the fact that any change in shape of the lingual wire from *C* to *C* will produce a certain degree of movement in the molar region, we will find in certain cases it is desirable to move the molars or expand the molars more than the canines. As a result of this, it is therefore necessary that we be familiar with the peculiarities of the action of wire under the wire-stretching pliers in order to produce the movement desired in the molar region. In Fig. 7 the heavy black line represents the lingual arch soldered to the molar bands. In this particular case it is desired to produce more of an expansion in the molar region than in the canine region, and also to produce an equal expansion of the molars on the right and the left side. This can be accomplished by placing the wire-stretching pliers at a point on the lingual arch represented by 1*A* and while the pinch is being made, traction is made upon the wire-stretching pliers towards the molars so as to change the position of the pliers from 1*A* to 2*A*. As a result, the position of the lingual arch will be changed as shown by the dotted line from *C* to *C* resulting in a pressure being placed on the molars represented by the dash line from *B* to *C*. This will throw the right and left molar region buccally in the relation as shown by the dotted line which of course will move the distal portion of the molar more buccally than the mesial portion.

We now realize that in some instances it is desirable to have this type of ex-

pansion of the molars; but instead of having the distal end of the molar moved more buccally than the mesial end, it is desired to move the mesial end equally as far as the distal. This movement of the molar buccally in a straight line is then produced by making a second pinch in the lingual arch in the region of the molar as shown in Fig. 8. In Fig. 8 the heavy black line represents the lingual arch as shown by the dash line in Fig. 7. It will be noted that the distal end of the heavy left back arch is thrown out the same as the alignment wire is in Fig. 5. Therefore, if it is desired to move the molars buccally without any torsiversion of the distal corner, the wire-stretching pliers is placed on the arch at *A* in the position as shown by drawing *1*. As a pinch is made, the handles of the pliers are rotated distally from position *1* to position *2* as shown by the solid and dotted handles. As a result of this movement a bend at point *A* is made in the alignment wire from *A* to *B* which has no elasticity. From *A* to *C* the alignment wire is sprung, and because of this elastic spring from *A* to *C* the lingual wire returns to the original position represented by the black line with the result that the dead bend from *A* to *B* stays in the alignment wire, effect-

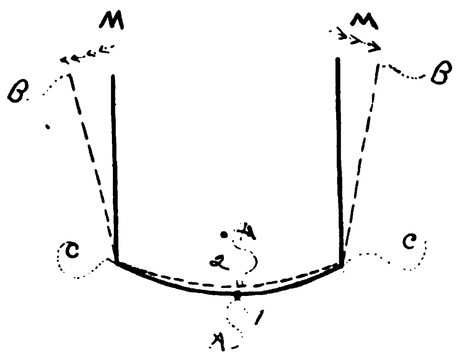

Fig. 7.

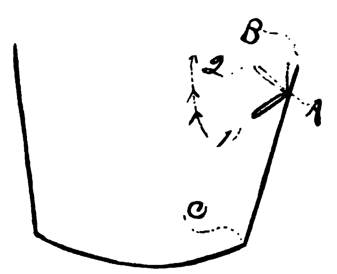

Fig. 8.

ing a change in the position from *A* to *B* as represented by the dotted line. Because of this dead bend in the alignment wire in the molar region the mesial corner of the molar will be rotated and made to occupy the position represented by the small dotted line.

By a careful study of Figs. 7 and 8 it will be seen what a change can be produced in the shape of the alignment wire by making the two pinches illustrated. The first pinch made in the incisal portion of the wire (Fig. 7) at point *A* and by moving the pliers distally at the same time the pinch is being made results in a change shown by the dash line in Fig. 7. After that pinch is made, the second pinch and bend shown in Fig. 8 made near the molar bend, results in the rotation of the molar. The various changes shown in the molars in these two diagrams must be carefully carried in mind and they also illustrate the necessity of being perfectly familiar with each pinch and bend that the wire-stretching pliers will produce upon the various teeth.

In Fig. 9 we have an illustration that shows the possibility of producing a lingual movement in the molars as a result of the wire-stretching pliers. Again, the heavy black line represents the shape of the alignment wire before any stress is brought to bear upon it by means of the wire-stretching pliers. In this illus-

tration, the wire-stretching pliers are placed in position shown by $1A$ which is an incisal portion of the arch somewhere between the canines C and as the pinch is made the pliers is forced forward with the result that the incisal section of the alignment wire is changed as represented by the dash line. The distal ends of the alignment wire, which are soldered to the molar bands, will be carried lingually, resulting in a narrowing of the molar region. There are very few cases in which a lingual movement of the molars is desired; but in those cases where it is desired, it is one of the most satisfactory means of accomplishing the change. The lingual movement of the molars has been accomplished in a great many cases when men have not desired that movement, because they unconsciously have produced stretching with the wire-stretching pliers which is illustrated in Fig. 9 in position $1A$ and $2A$ of the pliers.

It must be remembered that pinches made with the wire-stretching pliers at different positions will produce different changes in the shape of the alignment wire and therefore produce different tooth movements. It must also be remembered that a radical different change in the shape of the alignment wire will be produced when the pinch is made in a straight portion of the wire or when it

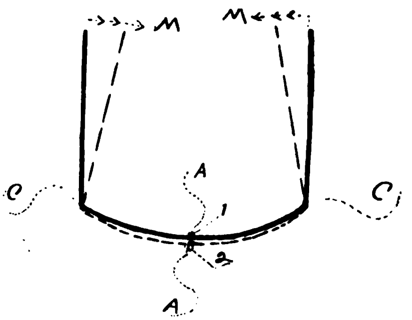

Fig. 9.

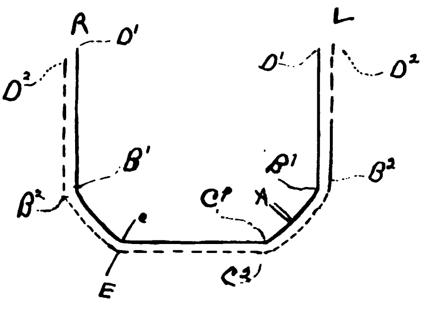

Fig. 10.

is made in a curved portion. A large majority of the lingual arches have a greater curve in the canine region as is illustrated in the curvature between *B1* and *C1* in Fig. 10. If the wire-stretching pliers represented by A pinch the wire in the curved section between *B1* and *C1*, it will result in a twofold movement which will be a carrying buccally of the premolar section to the dash line as shown between *B2* and *D2*. The portion of the alignment wire *C1* will be carried forward in the position shown at *C2*. This is the result of the lengthening produced by the pinch made at A in the curved portion of the alignment wire between B and C. It will be noticed that the incisal section of the alignment wire as represented by C and E have not been lengthened; neither has the premolar portion of the alignment wire represented by that portion between B and D. The only lengthening in the alignment wire has occurred in the curved section between B and C as a result of the pinch A.

Pinching the alignment wire between the points B and C, will exert a backward force upon the left molar that will tend to force it distally, as illustrated by the dash line as related to the solid line. A forward force will be exerted on the right molar which will tend to move it forward. This force can be utilized when it is desired to move one side of the arch forward and the other side back-

ward, always remembering that the movements will vary according to the resistance offered by the various teeth. This style of movement is utilized by Lourie.

Of course, several pinches can be made in that section of the alignment wire between *B* and *C* but each pinch, provided the wire-stretching pliers are held stationary and the pinch is made at right angles to the wire, will result in changes as shown by the dash line and the only lengthening will occur in that portion of the wire between *B* and *C*. If a pinch is made only in the curved portion of the alignment wire on one side as illustrated in Fig. 10, it will produce a change in the shape of the alignment wire as shown in the dash line. In other words, it will produce an expansion in the canine region of the dental arch on one side only resulting in what might be termed a warping of the dental arch which can be seen by studying Fig. 10. In a number of cases this style of tooth movement may be desired, but in other cases the operator may get this movement without knowing how he produces it and it may not be a desired movement. We therefore caution all who begin the use of the wire-stretching pliers to realize that the force produced is constant and every time a wire is pinched a particular and positive effect is produced according to the position in which the pinch is made, the manner in which the beaks are held or moved during that pinch, and the

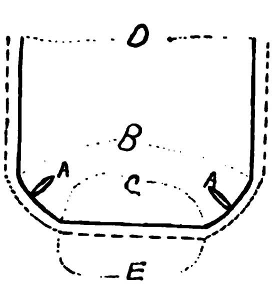

Fig. 11.

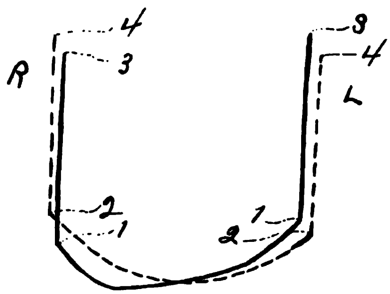

Fig. 12.

position in which the pliers are placed on the wire. Now this warping of the alignment wire as a result of the pinch in the curved section as shown in Fig. 10 may be desirable, in fact, it can be utilized to cause the alignment wire and dental arch to assume a shape which will result in moving the molar section forward on one side and distal on the other as before mentioned.

Fig. 11 shows the change in shape, which would occur if the alignment wire was pinched an equal amount in the canine region on the right and the left side. Pinches made in the wire between the points *B* and *C* would increase the length of the wire in that section and leave the length from *B* to *D* unchanged. Likewise the incisal portion of the wire *E* would be unchanged.

In Fig. 12 we have a diagram which requires a very careful study in order to realize the peculiar possibilities and movements which can be accomplished by the wire-stretching pliers used under certain conditions. Fig. 12 illustrates the possibilities of changing the shape of the lingual alignment wire by means of the wire-stretching pliers in such a manner as to move one lateral half of the arch forward and the other backward with no other force except the pinched wire. The heavy black diagram represents the shape of the alignment wire before any pinches are made. On the right side of the alignment wire marked *R* the

wire-stretching pliers are placed in the canine region at the point on the heavy line shown as *1*. As the pinch is made, the handle of the pliers is moved distally to the point shown at *2* which results in a change of the curvature of the alignment wire in that region represented by the dotted line. On the left hand side in the canine region, the pliers represented at *1* are placed on the wire and as the pinch is made the pliers are forced forward, causing a change in the curvature of the wire as again represented by the dotted line. This results in the canine portion of the lingual wire on the right side being so curved and shaped as to assume a distal spring, and the one on the left side is made to assume a mesial spring. As a result of this, the right premolar region of the alignment wire shifts distally from the position *3* to *4*. On the left side a mesial shifting occurs in the premolar region from the position *3* to *4*. It will be seen then by this diagram, as a result of the pinches as outlined, that the right half of the alignment wire has shifted backward and the left half has shifted forward. This movement is very desirable in certain cases and also may be produced accidentally if the operator is not familiar with the technic of the pliers.

In some cases we find it is desirable to place upon the canines bands to which a wire has been soldered. Very often with this style of appliance, it is desired to change the perpendicular relation of the canines, which can be very easily accomplished as shown in Fig. 13. The dark, heavy perpendicular line and the

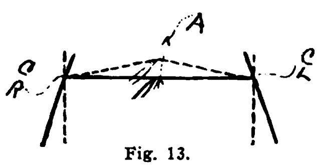

Fig. 13.

Fig. 14.

cross line represent the position of the canine and the position which the wire occupies before any pinch has been made in it. Now, if the wire-stretching pliers are placed at *A* in the position *1* and as the pinch is made the pliers are moved occlusally, it will result in a change in the wire which will produce a tipping of the apices towards each other and the moving of the crown buccally. A reverse movement of the canines can be accomplished as shown in Fig. 14 if the wire-stretching pliers *A* is placed at the first position *1* and as the pinch is made is moved gingivally to *2* which will change the wire in such a manner as to tip the crown lingually and the apices labially as shown by the dash line. Besides being possible to tip the canines in either direction as shown by Figs. 13 and 14 the expansion of the canine can also be accomplished by making straight pinches anywhere on the wire between the two canines.

In some cases where we have bands upon the canines to which a wire has been soldered, we find it is desirable to tip one canine mesially or distally or in some instances, one mesially and the other distally. This movement can be accomplished by putting a torsional spring in the wire as illustrated in Fig. 15. The heavy shaded lines, perpendicular and cross lines, represent the position of the canines which have been banded and connected by a labial wire. If it is desired to tip the right canine forward as represented by *B* and have a distal movement on the apex of the tooth, the wire-stretching pliers *A* are placed on

the wire in the position shown at *1*. As the pinch is made, the handles of the pliers are rotated occlusally, effecting a torsional bend in the wire represented by the arrow between *1* and *2*. Between the points *A* and *B* a dead bend is made in the wire owing to the short distance between the pinch and the soldered attachment. Between *A* and *C* a torsional spring is made which being a live spring causes that portion of the wire to return to its original shape, and the canine *B* is moved to the position represented by the dash line. There is an equal force exerted on the canine *C* which would have a tendency to tip that tooth in the position shown by the dash line.

In studying Fig. 15, it must be borne in mind that this movement occurs because of the fact that in rotating the pliers *A* from *1* to *2* a dead bend is made between *A* and *B*, while between *A* and *C* we have an active spring, or an active bend, which contains a spring force, that results in a portion of the wire from *A* to *C* returning to its original position; and in order for it to return to its original position, owing to the dead bend between *A* and *B*, the canine *B* must be rotated according to the position shown in the dash line.

If we should have a case of a canine in which it is desired to tip the crown distally and the apex mesially or forward, it can be accomplished by means of the

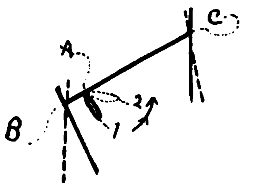

Fig. 15.

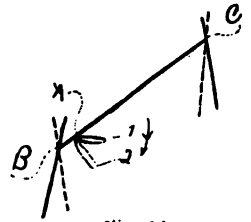

Fig. 16.

pinched wire and using the pliers as illustrated in Fig. 16. In this case the beaks of the pliers *A* are placed in the position shown at *1* and as the pinch is made, the handles of the pliers are rotated gingivally, which results in a dead bend between *A* and *B*, and an active torsional spring between *A* and *C*. As the active spring returns to its original shape and as the point between *A* and *B* is a dead bend, the canine *B* is made to assume the position shown by the dotted line. An opposite force is exerted on the other end of the appliance *C* which has a tendency to change the canine *C* in the opposite direction to *B*. In considering the possibilities of tooth movements as a result of the torsional spring, one can readily see what a large amount of harm can be done when an operator produces a torsional spring in the alignment wire unknowingly. In using a lingual alignment wire, which has the bands upon the molars, it must be remembered that tipping of the molars bucco-lingually can be very easily accomplished by making pinches in a certain position of the alignment wire and by producing certain movements of the wire-stretching pliers during this pinching.

In Fig. 17 the heavy black line represents a lingual alignment wire which has been soldered to molar bands and the original position of the molars are represented by the black perpendicular line. Now, if the wire-stretching pliers *A* are placed in the position shown at *1* and as the pinch is made, the pliers are moved gingivally but not rotated, the result will be a change in the shape of

the incisal section as represented by the dash line, which will produce a twist or a torsional spring in the premolar section represented by the arrow. As a result of this torsional spring in the premolar section, the occlusal portion of the molars will be tipped lingually and the apices will have a tendency to move buccally. In making this pinch and movement of the wire-stretching pliers as shown from *A1* to *A2,* the incisal section will assume a V-shape that is illustrated by the dash line. This bend in the incisal section will also have a tendency to narrow the lingual alignment wire in the canine region. In order to overcome this lingual narrowing in the canine region, if it is desirable to at the same time produce expansion of the canines, a series of small straight pinches must be made in the incisal portion of the arch to produce expansion which will overcome the narrowing of the lingual wire produced by the gingival bend from *1* to *2* at *A.*

Fig. 18 shows the possibility of tipping the occlusal surface of the molars buccally and the apices lingually by making the reverse movements as shown in Fig. 17. In this case, the wire-stretching pliers grasps the incisal portion of the lingual wire at *1* and as the pinch is made the wire is carried occlusally, which has a tendency to change the incisal section of the wire as represented by the

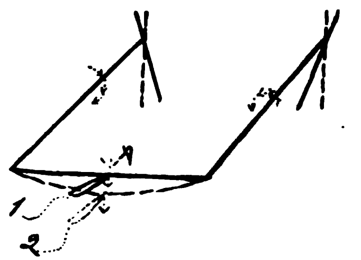

Fig. 17.

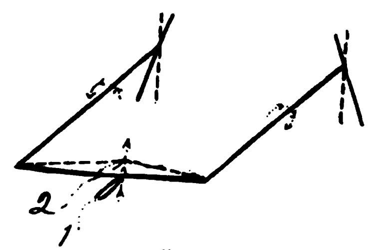

Fig. 18.

dash line and thereby produce torsion upon the premolar section as indicated by the arrows. This force moves the occlusal surface of the molars buccally and the apices lingually. While it is possible to rotate the molars by making a pinch and bend in the incisal region as shown in Fig. 18, it is preferable, if the rotation of the molars is desired, to produce that rotation by means of making a pinch in the premolar region, as shown in Fig. 19. Such change as produced in the alignment wire in Figs. 17 and 18 will produce a rotation or tipping of both molars, while such a pinch as made in Fig. 19 will produce a buccal or lingual movement of only one molar and produces this movement without the tendency of any change in the shape of the alignment wire in the incisal region. In Fig. 19 we again have the alignment wire represented by the heavy black line and the original position of the molars represented by the heavy black lines. The wire-stretching pliers is placed at point *A* in the first position represented by *1,* and as the pinch is made, the handle of the pliers is rotated occlusally to position *2* as shown by the dotted outline. The direction of the movement is represented by the heavy arrow. As a result of this movement of the wire-stretching pliers a dead bend is produced in the wire between *A* and *B.* All through the remaining portion of the lingual wire from *A* around through the incisal section and the premolar section of *C,* we have an active spring which

tends to return to its original position. As the alignment wire from *A* to *C*, which possesses the active spring produced by the pinch and movement of the pliers from *1* to *2* returns to its original position, the molar *B* is tipped as shown by the dash line which is a rotation of the crown lingually and the apices buccally.

If a reverse movement of the molar is desired, or a movement where the crown is moved buccally and the apices are tipped lingually, it will be possible to produce that movement by placing the wire-stretching pliers at the position *1* as shown in Fig. 20, and as the pinch is made, the handles are moved gingivally to the position shown at *2*. This again results in a dead bend between *A* to *B* and an active spring between *A* and *C*. As the alignment wire from *A* to *C* returns to its original shape, the crown of molar *B* will be tipped buccally, and the apices will be tipped gingivally or lingually. Fig. 21 shows the possibility of producing a tipping of the crown of the molar buccally by means of producing a torsional spring in the premolar section of the alignment wire by the proper use of the wire-stretching pliers. In addition to this tipping of the crown of the molar buccally by making a pinch in the incisal section of the arch as shown in Fig. 21 at *D* at the section *E1* will be lengthened to *E2*, thereby producing a lateral extension of the premolars and molars. The pinch made at *A* while the

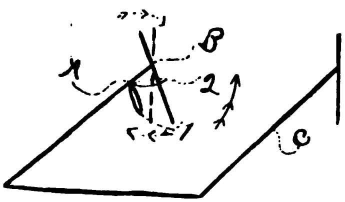

Fig. 19.

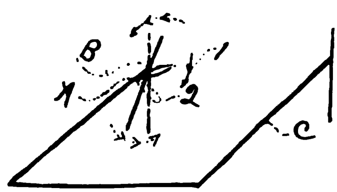

Fig. 20.

handles of the pliers are moved gingivally will result in a torsional bend which will move the crown of the right molar buccally, while the pinch at *O* will carry both molars buccally, but the one on the left side will be carried buccally without any occlusal tipping.

In some instances, it is desired to produce an elevation of one of the molars which can be accomplished according to the illustration Fig. 22. By placing the beaks of the wire-stretching pliers in the incisal section at *1* and rotating the handles gingivally to *2*, there will be produced a torsional spring in the alignment wire which will result in a change of the right side of the wire from the straight section shown at *MR* to the dash line. In other words, the molar on the right side will be elevated and there will be an equal tendency for the molar on the left side to be depressed, but owing to the difference of resistance, no movement of the left molar will occur.

I have endeavored to show the various movements which can be accomplished by the wire-stretching pliers by pinching the alignment wire in different positions, also how the change can be modified by movement of the pliers during the time the pinch is being made. If one has mastered the various possibilities of the wire-stretching pliers, practical application of the various movements which have been indicated can be made. It is equally necessary to know how

these movements are occurring and may occur in order that these changes may not be produced in cases where they are not desirable.

As a word of caution to all, the wire-stretching pliers present great mechanical possibilities and provide a force which is capable of moving teeth in many directions if properly applied. It must also be remembered that in using the wire-stretching pliers, every pinch on the wire will produce some movement and

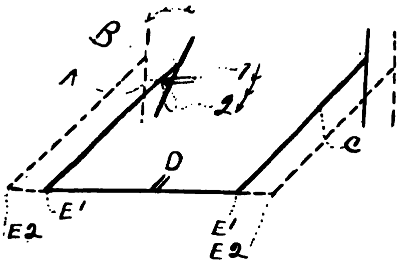

Fig. 21.

this movement will not be noticeable until a certain length of time has elapsed. It must be remembered that the force which you place on the wire as the result of a pinch may not be manifest or noticeable at the time the pinch is made, but nevertheless it is going to produce something in the end. I believe there is no instrument that offers so many possibilities of practical application as the wire-

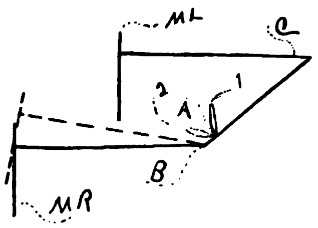

Fig. 22.

stretching pliers, and I am absolutely certain that there is no force capable of producing so much harm if improperly applied.

In closing, I wish to acknowledge the advice and assistance of Dr. Lloyd S. Lourie in preparing these diagrams, and to state that all of the mechanical principles outlined in this article are employed by him in his practice.

THIRD MOLAR INFLUENCE IN ORTHODONTIC CASES*

By Dr. H. L. Morehouse, Spokane, Wash.

IN SELECTING this subject for my contribution to this meeting, I did so because it was the one I had planned on presenting to you last year. In the meantime, however, Dewey published an article on the subject in the September issue of the *International Journal of Orthodontia,* but I still feel this subject needs further emphasizing. This I shall endeavor to do with a short paper and reports of a few cases in my own experience, where the third molars were extremely active.

From a dental standpoint, the question of third molar influence does not arise until between eighteen and twenty-five years of age, while from an orthodontic viewpoint, the question should be considered as early as twelve years.

Authorities on comparative anatomy claim that we are gradually evolving to a state where we will eventually be saved all the annoyance of these once essential members. Then think what a pleasure it will be to practice our chosen profession.

If we will watch our preventative cases closely during the period of eruption of the first permanent molars, we will find the same influence being exerted that later gives us trouble from the third. In fact, the pressure is a normal one, as it is nature's way of creating the stimulus necessary for the proper development of the bones of the two dental arches. From a careful study of the attending conditions, as well as the position of the erupting second molars, in Class II Division I cases, I believe we will find that in a great many instances, the action of the second molar will be found to answer the question of the etiology of these cases. In many cases where the second premolars have been locked out, we will find the action of the erupting second molars have forced the firsts mesially in the same manner and with the same result as is later brought about by the action of the third molars. The extent of the damage resulting from these erupting forces, depends on the amount of resistance the teeth anterior to them exert; their shape and form of the cusps, as well as the occlusion of the teeth. In some cases it will be found that the second molar force began very early, with the result that the first molar is occupying the space that belongs to the second premolar. The consequence is that it (second premolar) is either impacted or has been forced out of its normal position in the arch.

In cases where this has occurred, naturally the germ of the third molar has taken a position much further mesially than it otherwise would. If, then, we endeavor to establish normal occlusion without an extraction, the condition will be complicated more than ever. This must have been the experience of James Robertson to whom Weinberger refers in his *History of Orthodontia.* Robertson published, in the *Dental Review,* of London, in 1895, an article on

*Read before the Pacific Coast Society of Orthodontists. San Francisco, Calif., Feb. 18, 1918.

the *Cause of Irregularity of the Teeth* in which he says, "The growth and advent of the third molar, when an insufficient space exists for its development is not only a source of great suffering, but frequently the immediate cause of irregularity by the pressure exerted toward the anterior teeth of the mouth which until their development, presented a regular denture." Thus we see that the third molar action is nothing new, but until the last few years it was overlooked by us, as orthodontists, in our anxiety to perfect the treatment and mechanical devices.

I have models of three normally developed cases of about twenty-five years of age where the third molars, in erupting, had forced all the other teeth mesially, crowding one lower incisor out of the line of occlusion; another of about the same age in which the upper centrals were gradually lapping. I advised the extraction of the thirds and a year later the young lady reported that the condition had corrected itself.

It is very apparent that this offending third molar has been the cause of a great many of the failures which, before the advent of the x-ray for diagnosis, we could not account for.

Though this may be the case, it does not necessarily mean that we are not justified in urging the treatment of cases at an early age, (rather the opposite,) for in the treatment of preventive cases, I believe the patient is getting the most for his money and there is less likelihood of any slipping in the future. With the use of the x-ray from time to time, we can guard against any mesial movement by means of retainers until such a time as seems best for the removal of the offending members or some other tooth as the case demands. However, in the preventive cases, I feel there will be found the least amount of trouble from this source, for the development is nearer that of Nature's work, unassisted by mechanical devices.

About seven years ago, I recall the first case in which I suspected the trouble, that of a young lady eighteen years of age with a Class II, Division 1, Subdivision, in which the upper right cuspid had erupted labially. After a number of months' treatment, I felt that the distal movement was not what it should be, and on x-ray examination, the picture disclosed an impacted upper third molar. This was removed and the case finished splendidly. Later she had the others removed and I experienced no trouble with the retention. This did not arouse my suspicion except for cases of about that age or older.

The next case is another Class II, Division 1 of a girl fifteen for whom no x-ray was taken until the later part of the treatment, disclosing the condition shown in Fig. 1. Here two actions were taking place; the lower thirds were locked distal to the seconds, forcing the first and seconds into position of supraocclusion; the upper thirds were badly impacted above the seconds making it impossible to get normal mesio-distal relation. I had the upper seconds extracted and the lower thirds removed and feel sure that no further trouble will be experienced.

Fig. 2, a Class II, Division 2, case shows trouble only in the lower in which the thirds are causing supraocclusion of the first and second molars, giving the effect of infra-occlusion of the rest of the teeth. The worst of this case was

Fig. 1.

Fig. 2.

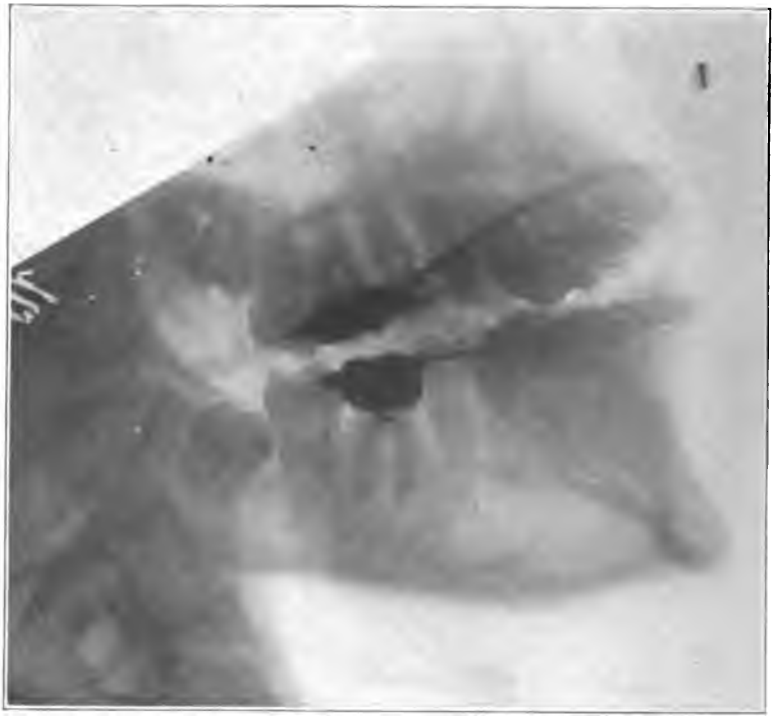

Fig. 3.

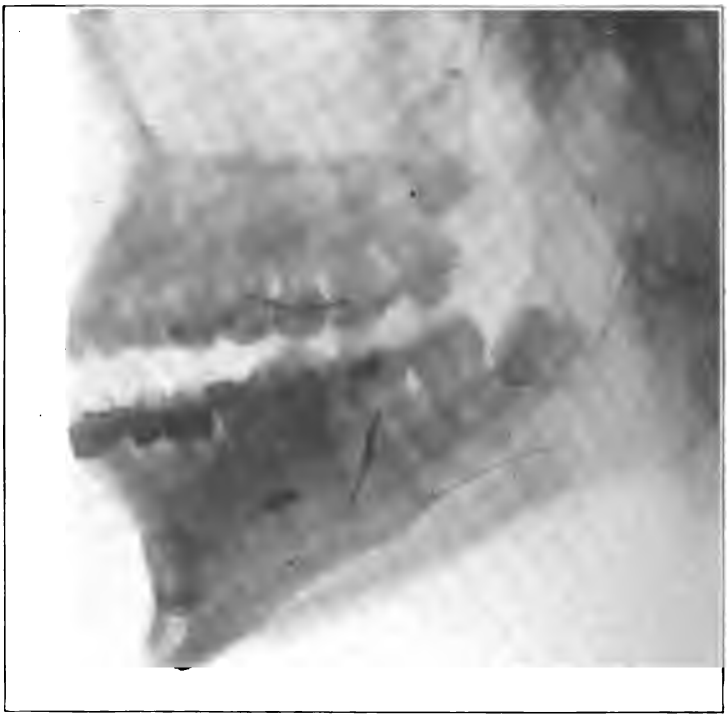

Fig. 4.

Fig. 5.

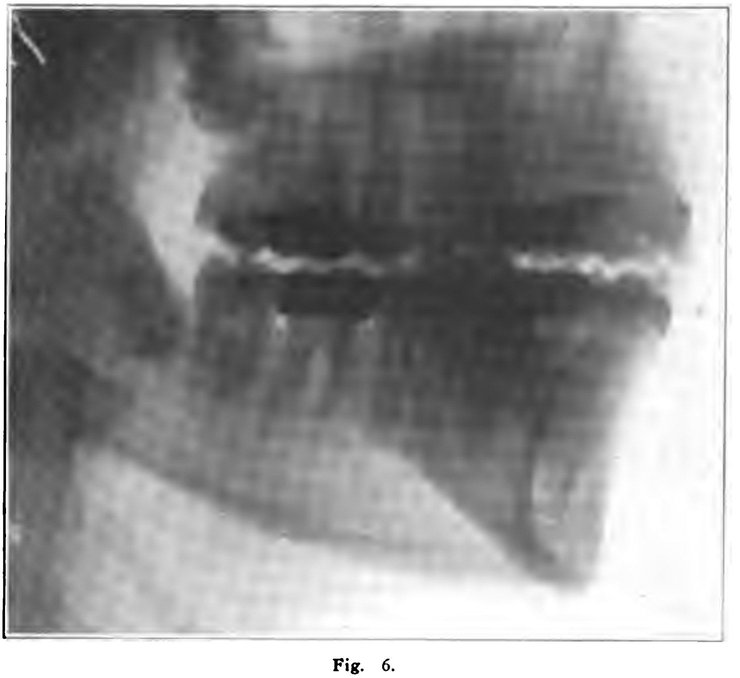

Fig. 6.

Fig. 7.

Fig. 8.

that it did not develop until six months after retention and then the parents delayed having the lower thirds removed until the tissue had been built beneath the other molars, with the result that the case had to be retreated as one of infra-occlusion in the incisors.

Fig. 3 is of a Class I case which during treatment developed a supra-occlusion of the first and second lower molars, the cause of which is clearly shown in the x-ray, but unlike the second case, the lower thirds were removed at once and the appliances left off for about three months with the result that the teeth settled back to normal themselves and have given no further trouble.

Figs. 4 and 5 are of Class II, Division 2, cases, mutilated on one side with an unerupted upper second premolar on the other. Fig. 4 shows the upper second premolar in position, but the operation of opening the space for the unerupted tooth complicated the impaction on that side. It also shows a badly impacted lower third, which condition is also found in Fig. 5. These lower thirds were causing a movement mesially of all the lower teeth. I had both lower thirds removed, also the upper right second in Fig. 4 and no further trouble is anticipated.

The question will arise in most minds at once, would it not have been better to have waited until the second premolar did erupt and extract that, thus saving the patient the long treatment. This might have been best had the x-ray disclosed the impacted lower thirds at that time. In some ways the condition shown in Fig. 5 answers the question.

Fig. 6 is of a Class I case with the usual prominent cuspids of a boy of thirteen. The father of this boy was a "Doubting Thomas," and in order to be certain that nothing went wrong, I had used every precaution in the treatment. After retaining the case for about a year, I removed the upper retention, feeling certain the occlusion would hold the case. Four months later I discovered I was falling heir to a beautiful Class II case and immediately upon x-ray examination the reason was plain; it showed badly impacted upper thirds. It also disclosed the lower thirds in a position which, from experience, I knew would give trouble later, so had those removed also.

Fig. 7 is one of the most disheartening of any I have ever had under treatment. It is a Class II, Division 1 case which I treated some eight years ago. The girl was seventeen years of age. After correction of the case, I held the arches under retention for about two years. They were then gradually removed. The arches showed no signs of buckling for nearly three years, when they started. As soon as I discovered the condition, radiographs disclosed what you see on the screen. The worst of it all is that she refuses to have them removed and I have disclaimed any future responsibility for the case.

Fig. 8 is not one of the third molar trouble, but one which is very seldom encountered, that of a cystic odontoma in a girl nine years old, which I thought might be of interest to some of you.

I feel that radiograms should be taken at regular intervals of six months to a year, according to the condition that shows in the first picture.

In closing, if there are any who have been in doubt as to the trouble these

impacted third molars can inflict on our young patients, I trust that these few illustrations will have emphasized the danger which lies in wait for them if they do not heed the signs.

DISCUSSION

Dr. Wm. Cavanagh.—You have listened to one of the papers that should make us glad to be here. To detect just such unseen and unsuspected sources of malocclusion as Dr. Morehouse has pointed out will doubtless save many of us as much time as is required to make the journey to San Francisco and return. I think the paper is deserving of a very thorough discussion.

Dr. Robert Dunn.—It is rather difficult for me to discuss this paper as I am not in a position to do it justice. The Doctor states that from the orthodontist's viewpoint the influence of the third molar should be considered about as early as the twelfth year. I believe there are instances where it would be well to consider this matter in patients even younger than that. All with any considerable practice in orthodontia have doubtless had some very sad experiences with third molars. Work carefully done has been upset. Retainers have been removed and the patients have returned to have the appliances replaced and readjusted, and the statement is made, "I was in the care of Dr. ——, and had my teeth corrected and they would not stay; I am not going back again, etc." Students of comparative anatomy claim the time is coming when we will not be troubled with third molars, but I think this is a dream, and as long as we live we will have third molars to contend with. I do not believe the race is losing any of its teeth.

Dr. Morehouse did not make much reference to Class III cases. I have handled a great number of patients, having this type of malocclusion. It seems to have been my lot to treat many of them. In every one of these cases you can see the influence of the third molar after a certain age. Unless you have those teeth removed you will probably not succeed in completing the treatment of these cases for a number of years. Even if the teeth are removed, in case it is not done early enough, the tendency is to revert.

One point not mentioned in the paper is a combination of influence of the third molar and bad dental restorations. Gentlemen, there are many failures in orthodontia due to faulty dental restoration. A wrongly formed inclined plane,—incorrect contact points, etc., and you have the pressure of the third molar on the second molar, tending to move the second molar lingually, or buccally. The first permanent molar, or premolar tooth may be affected.

Dr. Morehouse spoke of impacted premolars. The question arises, what are we going to do with those cases? In case the third molars are not already impacted, will they become so through our operations to make space for the premolars?

Dr. John R. McCoy.—I think that as has already been stated this paper is going to be worth a great deal to us. I have always realized that the third molar must have its influence in causing a recurrence of malocclusion, and I can look over some of my cases right now and see where the extraction of those teeth may be of immense value.

Speaking of Class III cases, I believe from now on there will be more and more of those lower third molars removed. I shall attend to it in my own practice, as a matter of precaution.

The value of the x-ray in orthodontia is certainly represented in this work, and I think most of us have used it far too little, usually because it puts the patient to a little expense or trouble, when probably it would save the patient a great deal of trouble and ourselves much expense if we used it more.

Dr. Suggett.—I think Dr. Morehouse's paper will save me a lot of trouble in the future. I think the idea we got a few years ago of the maximum number of teeth in the mouth, with every tooth in its place, was a bit exaggerated, and we have been afraid of breaking the rule and of being independent enough to remove any teeth. There are cases where the removal of the second molar will result in its replacement by the third molar, and in other instances the third molar should be removed. I have had many cases where I am sure such a procedure would have saved me much trouble. Two years after treatment I have had buckling up of the cases, and a return of the teeth to their abnormal positions, due, I am sure, to the influence of the third molars.

Another interesting question in this connection is, When does our responsibility cease? The question is a rather debatable one.

Dr. Mann.—I think the Society is to be congratulated in having a paper of this sort presented to it. I can now see how much trouble might have been avoided in my own

practice earlier had I come into the light as Dr. Morehouse has done. I however agree very fervently with Dr. Dunn, that these cases should be observed even earlier than twelve years of age. In one case recently under observation in my practice, that force was obviously in operation at the age of seven to eight years to such a great extent that the first molar was impacted behind the second deciduous molar and the second deciduous molar had become eroded so that a shelf was formed which held the first molar in an impacted position, and did not permit of its eruption.

As to the question of the restoration of lost structure, mesio-distal diameters, etc., I think the greatest trouble we have is what is known as "plus contact points." It is a method followed by dentists who are doing what is now known as very modern dental restoration. It seems to me if a better understanding of normal mesio-distal diameters was had among dentists, we probably would have much less trouble in the question Dr. Dunn brought up.

Dr. James D. McCoy.—Mr. Chairman: The baneful effects in these third molars in producing recurrent malocclusion, has been very forcibly brought to my attention in many cases which I have treated. In an attempt to work out some practical method of preventing the trouble, I have frequently made radiograms at the time retainers were adjusted, in order to locate the relationship of these teeth to the second molars, and have impressed this fact on the patients, that the retainers must not be removed until those teeth had either erupted or until their eruption can be foreseen by subsequent radiographic examination and the diagnosis made that they may not afford any complications. I observe another precaution in all these cases that remain under my observation. I construct a retainer on the lower arch from cuspid to cuspid, with a lingual wire extending far enough distally to include the surfaces of the first premolars,—so that that portion of the lower arch will be supported against the pressure of the lower third molars. I have not experienced much difficulty with the upper third molars, except that these teeth may have influenced the eruption of the upper second molars, pushing them forward and causing them to erupt in buccal relation to the lower teeth.

By the construction of the lower retainer referred to, and impressing the patient, that the retainer must remain until the third molars have erupted, I have avoided many recurrences that formerly I was unable to prevent. Following out our present plan in the office of making a radiographic survey of all cases prior to treatment, as a routine part of the examination, we will discover these complications and be able to avoid trouble very often. Where there is a mixed dentition, with deciduous molars still present, etc., we make radiograms, using the extraoral method, getting an adequate survey of both upper and lower arch, embracing all teeth posterior to the canines, and if the third molars present any complication we can check up on these teeth later.

I think the most common form of recurrence is the trouble to be found in the lower arch in the crowding of the incisors and canines. A number of cases have left my regular care at perhaps the ages of ten to twelve years—with all retainers removed. They have been kept under observation from time to time, seeing them over a period of two or three years,—long enough to be sure no future trouble would recur. Then I have seen them three to five years later and found this crowded condition of the lower teeth present, and even although the upper teeth do not bunch up, they are influenced by the relationship of the lower teeth because they usually accommodate themselves to the lower teeth. So that the construction of this little retainer, giving the lower arch support, including the canines and first premolars, saves me a great deal of trouble.

Dr. Carter.—Mr. President: My attention has been called to the influence of the third molar in these cases of malocclusion, because of the fact I do a great deal of radiographic work. As a routine in my office, whenever I accept a case for treatment, the first thing I do is to make a complete set of radiograms, and because of this fact, and also because of the fact I do radiographic work for members of the profession, the matter under discussion has been of much interest to me.

I have a case in mind where a dentist sent a patient to me to see if I could discover why the second molars had not erupted. The patient was about twenty-five years of age. On making a radiographic examination I discovered the third molars were completely inverted and had depressed the second molars on both sides in the lower jaw. They had locked on the cusps of the second molar, so those teeth never erupted. You could see the influence of the depression. The roots of the teeth were locked just like a bow-legged man, and that happened on both sides.

Dr. Dunn mentioned the influence of imperfect restorations, i. e., as to the mesio-distal diameter of the tooth. I believe a good many cases of recurrence of malocclusion

are due to these improper restorations. I have noted many cases of relapse, due I am sure to the causes mentioned here this morning. I have taken a great deal of pleasure in explaining to such patients that have chanced to come under my observation, the reason for the trouble. Naturally they seem to think it the fault of the orthodontist, and because of the fact the dentist does not understand why we have these recurrences I sometimes think it would be a very good thing if we could give the dental profession some education along that line, and then they would not be so prone to blame the orthodontist for cases that may have relapsed.

Dr. Solley.—I would like to ask a question with reference to the last case that Dr. Logan operated on. Did you see the splint used there?

Dr. Morehouse.—No. He said he reenforced the jaw before operating.

Dr. Cavanagh.—It seems to me this paper would explain why we are disposed to allow the retainers to remain longer on the lower teeth than the upper. Impactions of the third molars occur more frequently in the lower arch than in the upper, and the anterior teeth are often crowded back into imperfect alignment in spite of proper retention. It occurs to me now that perhaps the third molar has been causing many of my complications, and I shall patronize the radiographer more often hereafter.

Dr. Morehouse.—With regard to the point spoken of by Dr. Suggett, as to the absorption of roots, I think we should be very careful not to make too quick judgment as to the radiographic appearances regarding the absorption of impacted teeth. I recall two instances of the discovery of impacted lower third molars, and the radiograms showed as pretty as could be an apparent absorption of the distal surface of the root of the lower second molars—a complete cupping out. This was both from my own diagnosis and that of the radiographer, and it was thought the second molar should be removed. We removed the tooth and there was absolutely not a particle of absorption. I have seen a number of instances where absorption seemed apparent in the other teeth, where, as a matter of fact, there was none. So I should want the radiographs made from different angles, etc.

Dr. Wilson showed me in San Diego radiograms of a case of an impacted upper canine in a boy of fifteen years of age. The tooth occupied a horizontal position, and apparently one-third of the lateral incisor root was absorbed. He had anticipated making some tooth movement and anchoring to the lateral, but the radiogram caused him to feel he did not have enough support there. I told him I doubted very much if he would find the absorption which the radiogram seemed to show. We have to be very careful, lest we find we have been misled, even though radiograms are made.

In regard to the impacted third molars as shown on the slide we all recognize the impacted canine and its influence in causing malposition of the lateral incisor—especially in the upper arch. The canine lying on the apical end of the lateral causes it to tip into an abnormal position. I think if taken early enough, we will discover, as Dr. Dunn suggests, even earlier than twelve years,—we will find very often the third molar exerts a tremendous influence on the shifting mesially of the other teeth. Invariably the root of the canine is in its normal position, and the cusp of the tooth is in a mesial position.

I hoped the discussion would bring out the question of whether to extract the third molar or the upper second molar. I think it better to lose the upper second molar in some cases, dependent on the condition of the mouth as to caries, etc. When I first advocated the extraction of the upper second molars to the profession in Spokane, they threw up their hands and thought I was too radical. They thought the upper third molar is a useless organ, even after it erupts. I combated that with the argument that it was a great deal like a bad apple in a barrel, and that it is a question of environment. I stated if the third molar takes the place of the second molar, the third molar would have a better chance of being a good tooth than the second molar, as it came at a time in life when the system was not being drained, and it had a better opportunity of being thoroughly calcified than at any other time in life, and thus it should be a better tooth than the second molar. And so I feel in some cases I am doing a patient greater justice in removing the upper second molar rather than the third molar.

Dr. Carter.—I would like to ask Dr. Morehouse in relation to this. Was it a lateral in Dr. Wilson's case?

Dr. Morehouse.—Yes.

Dr. Carter.—What was the position of the lateral in relation to the central?

Dr. Morehouse.—Normal.

Dr. Carter.—In normal position. I was going to suggest an error might be made on account of foreshortening.

THE RELATION OF THE DEVELOPMENT OF THE NASAL FOSSA TO THAT OF THE ORAL CAVITY*

By J. T. Dowling, M.D., Seattle, Wash.

THIS subject has always been of very great interest to me as a doctor and a rhinologist. It has a humanitarian and social side. The condition begins in the early life of the child, causes untold misery and distress, attacks the individual when he is least able to protect himself and worst of all, can be prevented absolutely by proper care and treatment by parent, doctor and dentist. So our duty is education, prevention and treatment.

General Considerations.—First, congenital deformities of dental arch. I will say that this phase of the question may be passed, by mentioning cleft palate, complete and partial, and has very little to do with the scope of this paper.

In discussing this question before your dental society, I will not presume to enumerate the various dental conditions or deformities as they may exist, since you gentlemen are much more familiar with the conditions than I could possibly be.

In the mind of the rhinologist and laryngologist the most important cause of nasal and dental deformities is adenoids, or hypertrophy of the pharyngeal tonsils. The pharyngeal tonsil, as you know, is situated in the nasopharynx. It is a gland and a physiologic structure. It becomes a menace to the health and development of the child only when it becomes enlarged and pathologic thereby causing obstruction to normal breathing. As this tissue usually atrophies before adult life, attention is generally directed to this structure in early childhood. Whether the enlargement is congenital or occurs soon after birth matters little, as the main symptom demanding relief is the obstruction to nasal respiration, which, if unimpaired as the process of development goes on, has much to do with the regular formation and contour of the face and dental arch. The respiratory acts through the nose, as well as the action of the muscles controlling the nasal orifices, is a factor of importance in controlling the size of the nasal cavity. If this function is interfered with by any obstructive lesion, as would occur in adenoid vegetation, and that obstruction is allowed to remain until the osseous nasal framework has become firmly fixed, the capacity for nasal breathing is permanently fixed; and even should the glandular structure causing the obstruction be removed, while the ablation may relieve the nasopharyngeal symptoms, it can not possibly increase nasal respiration, other than by lessening the engorgement of the submucosa subsequent to such obstruction. This fixity of the bones of the face may leave the individual a confirmed mouth breather. This is the reason why, as frequently happens, the adenoid operation does not cure the child of mouth breathing although the ablation of the adenoid tissue may be perfectly done.

The effect of impaired respiration, due to postnasal obstruction is also manifested in an ill-formed maxillary arch, with marked irregularity in the

*Read before the King County Dental Society, Seattle, Wash., April 2, 1918.

arrangement of the teeth. The irregular development is largely caused by the repeated contraction of the muscles controlling the nasal orifices, necessitated by the forced nasal inspiration and snuffing. By the drawing down of the facial muscles the upper jaw is retracted and the contour of the upper arch is altered. The hard palate, then, instead of forming a perfect dome, has its anterior portion tilted out and its upper portion, at the base of the nose, drawn in. Without this interference the pressure of the air within the natural passage counterbalances that upon the external surface and normal development takes place. This, of course, will occur only when the obstruction takes place in early life, before the bones are firmly united. This irregularity in the arch will produce unevenness in the development of the teeth, causing their eruption high up in the alveolar process, or, if placed in the arch, they will be crowded and irregular. If the eruption occurs high up it will add to the protrusion of the upper lip, increasing the facial deformity so characteristic of adenoid obstruction. Inherited tendency to adenoids is often, in reality, the inherited family nose, children with the narrow slitlike orifice being more prone to thickening of the adenoid structure than those having a wide open nostril. As a rule, this postnasal obstruction, due to adenoids, interferes with both nostrils, yet occasionally it is one-sided. I have seen several such cases and unless the obstruction be removed early in life, irregular one-sided development and uneven facial contour and dental contour is observed. This condition then may precede and be the cause of anterior nasal stenosis, or the latter condition may be a factor in the enlargement of the adenoids.

In clearing the nasopharynx of adenoid vegetation, one must be very careful to completely remove all of the vegetation or they may recur. I wish to most earnestly emphasize the removal of the faucial tonsils at the time of operation on the adenoid enlargement. Many times I have found that the adenoid obstruction had recurred simply because some of my fellow-practitioners had neglected to remove the tonsils at the time of the adenoid operation, either through ignorance of the true pathology of the condition or on the plea that the child could not withstand the combined tonsil and adenoid operation. To my mind this is all wrong, first because of the greater tendency of recurrence of the adenoids, and secondly, it subjects the little one to an additionl subsequent operation. Unless there is a very clear contraindication to the combined operation of tonsillectomy and adenectomy, I refuse to operate now on adenoids alone.

The age of most frequent enlargement of adenoids is between the third and tenth years, although they may begin before the third year or exsit at birth. From the tenth to the fifteenth year the structure undergoes physiological atrophy. This may occur even if the tissue is not enlarged, as well as when it is the subject of pathological changes. Sex is not associated as an etiological factor.

The fact that enlargement may occur in several children in the same family, involves the question of heredity only as to the inherited family nose or lymphatic enlargement. This is, in my mind, another explanation for the occurrence of malocclusion in all or several children of the same family. In constitutional dyscrasias, as in the syphilitic or tubercular condition, there is

a tendency to general glandular involvement, which is increased by the fact that from the lessened physiological resistance and diminished vascular tone there is a tendency to sluggish circulation in lax structure, especially the mucous membrane. This will tend to engorgement and watery infiltration, more marked where the lymph-channels are numerous. Any condition bringing about anemia will produce this phenomenon.

As we all know, syphilis and tuberculosis in the young have a decided action on the permanent teeth and the formation of the nasal and nasopharyngeal cavities. The former have a special action on the second teeth, the so-called "Hutchinson" teeth which is a common diagnostic point in congenital syphilis.

Climate is an important exciting factor, the enlargement of the adenoid tissue being more common in damp climates or in locations in which there are sudden changes in temperature. Poor hygiene and improper feeding or lack of sufficient nourishing food tend to nasal obstruction and hence nasal deformity and mouth deformity. Children living in cities seem more prone to nasal and mouth deformities than those living in rural districts. This is probably due to the breathing of dust-laden air and to the crowding together in the tenement settlements of our large cities.

I have, you all have, seen the child with nasal obstruction and when I speak of nasal obstruction in the broad sense, I mean adenoid obstruction. The patient is a mouth breather, or at least a "night" mouth breather. The facial expression is characteristic, a dull look to obliteration of the labio-nasal fold, protruding of the upper lip and often the anterior portion of the superior maxillary ridge. The bridge of the nose is flattened and the alæ of the nose are drawn in, due to the constant pulling effort to get breath through the nose. Early the irregularity of the teeth occurs, hence the need of early correction of the condition. The lower jaw hangs, giving the child an appearance of dullness and an inability for concentration of thought or attention. All of the symptoms are much aggravated by "colds." These in turn tend to produce greater obstruction and to lower the child's immunity so that often it suffers from an almost continuous cold and infection.

While the scope of this paper no doubt is very broad, I have tried to take up that portion of dental arch deformity caused by nasal obstruction, due to adenoids. This phase, as a rhinologist, I am best able to discuss. I believe that a large percentage of dental arch deformities, at least 45 per cent, are due to adenoids, and nasal obstruction in the young. There should be a much closer cooperation, not only between the orthodontist and the rhinologist, but between the general dental practitioner and the rhinologist. The orthodontist can not hope for much success in the correction of arch deformities unless all nasal obstructions are cleared away and the rhinologist should endeavor to impress upon his patients the vital health-giving necessity of a good, normal dental arch and proper occlusion of the teeth. The child or youth who starts out in life with a mouth full of teeth that have the setting of tusks, not only has a hard fight from a health standpoint, but from a social one as well.

I wish to take this opportunity of thanking you for the privilege of addressing your honorable society.

REMOVAL OF THIRTY DENTICLES FROM ONE BICUSPID SOCKET*

By Bundy Allen, M.D., Iowa City, Iowa

Roentgenologist, University Hospital, State University of Iowa, College of Medicine

MAY 29, 1917, a woman, aged 23, called my attention to a slight prominence of the gum buccally to the upper right bicuspid region which had not produced any symptoms other than the elevation of the tissue. Fig. 1 is a roentgenogram of the upper right bicuspid region showing the presence of a collection

Fig. 1.

Fig. 2.

of denticles. The patient was referred to Dr. John Voss, of Iowa City, Iowa, who extracted thirty denticles from the first bicuspid socket (Fig. 2). All teeth were present, and occlusion was perfect, excepting for the third molars, which had not erupted.

*Reprinted from The Journal of the American Medical Association, April 27, 1918, vol. 70, p. 1224.

THE HISTORY OF ORTHODONTIA

(Continued from page 250.)

By Bernhard Wolf Weinberger, D.D.S., New York City

W. G. A. BONWILL (1833-99) before the Delaware Dental Society in 1863 described his "system" of regulating teeth. In the Proceedings this paper appears under the title of *Orthodontia,* however "on account of its length it was refused publication in the *Dental Cosmos.*"

In 1888 Bonwill read or reread part of this paper before the New York

Fig. 1.—W. G. A. Bonwill (1833-99).

First District Dental Society, under *Original Devices for Correcting Irregularities of the Teeth Since* 1854, *Not Hitherto Known to the Profession.* Again on account of its length it did not appear among the First District's Transactions in the *Cosmos.* However, we undoubtedly find this same paper in the *International Dental Journal,* 1889, under *Regulators and Methods of Correcting Irregularities,* in which Bonwill quotes part of the paper read in 1863.

Bonwill said, "My first essay on orthodontia was written in 1862. To make my own history more replete, however, it is necessary to show what I have done in this line of work since 1854. As the apparatus was then entirely new and the practice considered rather radical for the time, and as it has since been revived by others, I shall briefly present them here.

"From the following language it will be seen that the Coffin Plate of rubber was anticipated by me, except that I used silver wire made spiral, and adjustable or detachable from the plate previous to 1862.

"If the inferior jaw, I clasp, where possible, and when not, strike up a plate to cover the deciduous or permanent teeth, as they may be, and operate from this. From the inward inclination of the inferior bicuspids and molars (or molars alone of the temporary set) there will be sufficient firmness gained by making it to press outwards at these points.

"If there are no other means of holding it in the inferior jaw, an India rubber plate made to fit accurately either the teeth or palate, or both; and if you desire, the surface of the vulcanized plate can be roughened to enable the patient to masticate thereon, and screw the spiral springs into this.

"This I seldom use, being bulky and dirty and far more liable to injure the faces of the teeth. More can be done with the spiral springs soldered to a metal plate.

"Instead of contracted jaws from extraction and caries, it is the compressed

Fig. 2.—Silver plate as used by Bonwill in 1863.

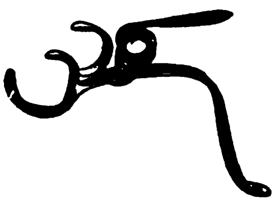

Fig. 3.—Arch as used by Bonwill with spiral springs.

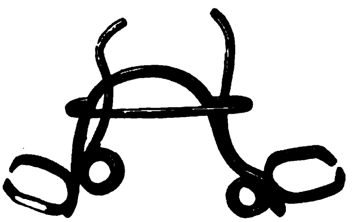

Fig. 4.—Arch and bands used by Bonwill with spiral springs.

alveolar borders, and the want of resistance in them, which prevents normal mandibular action, and consequently healthy nutrition can not result.

"Figs. 2 to 7 show the spiral spring in various phases and which are illustrations of the original apparatus for the correction of irregularities used in illustrating my paper read before the Delaware Dental Society in 1863, above referred to. It will be observed that the 'Talbot spiral spring' is a true reproduction of the Figs. 2 to 7.

"Fig. 2 represents a silver plate made to fit the inferior incisors, and which was tied on a central, to correct a superior central from the inclined projection on the right; the end of the spring acted on the right inferior central to throw it out of the arch.

"Figs. 3, 4, 5 represent metal bands with clasps, with the spiral spring soft-soldered under a metal loop hard-soldered to the band. This retains the temper. These are used on many teeth in either jaw.

"Fig. 5 shows a metal plate with half-clasps fitted to the bicuspids, to hold it in position. The spiral spring is soft-soldered to the plate. This can be

changed to various positions on the plate, and is applicable in cases where it is difficult to place the clasp entirely around a tooth.

"Fig. 6 was made for drawing backward the four incisors of the inferior jaw with spiral springs, adjusted so as not to interfere with the tongue or the superior teeth. The piece at *A* goes over the incisors, and is held by ligatures tied to one or more of the teeth.

"Fig. 7 shows a jack-spring for constant pressure. It may be made in a curve to conform to the hard palate. It is very powerful and effective, and superior to a jackscrew.

"In all these spiral-spring appliances, the spring is tied to the tooth to be acted upon to hold it from slipping; or, in some cases, a hole drilled into the tooth is better.

"*Jackscrews.*—Figs. 8 and 9 represent two patterns of jackscrews which

Fig. 5.—Metal plate with clasps and spiral springs.

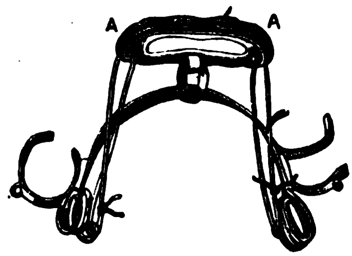

Fig. 6.—Bonwill's method of retracting upper incisors (1863.)

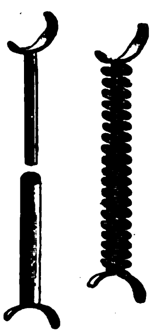

Fig. 7.—Jack's springs.

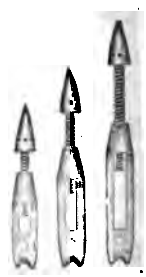

Fig. 8.—McCollom's jackscrew.

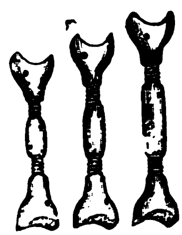

Fig. 9.—C. S. Longstreet's jackscrew.

were placed on the market by Drs. A. McCollom and C. S. Longstreet. As will be seen the one shown in Fig. 8 closely resembles E. C. Angell's device, while the one in Fig. 9 resembles that of Dwinelle. Dwinelle's and Longstreet's jackscrews have but one screw and are more scientific than those constructed with the reverse screws as shown in Fig. 8, not only because they are simpler, but they are more easily operated."

W. H. Coffin before the International Medical Congress in London, 1881, presented a paper describing what he termed *A Generalized Treatment of Irregularities. The Expansion Method* that had been used in practice by his father, Dr. Coffin and Dr. Peter Headridge, since 1869. This method attracted general attention before Coffin read his paper, for we find it described and illus-

trated in an article by Alfred Coleman, in the *Transactions of the Odontological Society of Great Britain*, 1877, page 111, in which he states it had been in use for years. It consisted of a vulcanite plate, capping the teeth, unless held in by clasps, wire or ligatures, divided in the median line of the palate into two halves, which were held together by a piece of pianoforte wire bent in W shape. (Fig. 10.) This acted as a spring and by opening the plate gradually enlarged the dental arch. The advantages of such an arrangement are, "steadiness and uniformity of action, together with the avoidance of numerous visits so necessary in such cases." Coffin said, "A large class, uncomplicated by crowding, in which aberrant teeth are easily replaced, admit of direct and immediate correction by suitable means (a simplification of which will be alluded to).

"Of the remainder, the majority are cases of every variety, in which the teeth—not really too large or too numerous for the jaw they might symmetrically occupy—are, by some chance of their eruption, irregularly disposed, interlocked, and crowded. Of these it may be affirmed, quite generally, that rectification necessitates the movement of many teeth or all, and an altered shape or outline of the dental arch; for any attempted direct adjustment of individual teeth will be accompanied by such a disturbance, more or less extensive. These present the greatest difficulty in regulating by the usual way especially with a

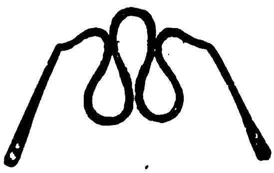

Fig. 10.—Pianoforte wire bent in W-shape for Coffin's plate.

rigid plate; but in the most intricate or the simplest of them, the permissive control of the general tendency of movement during regulation reduces their successful treatment to comparative ease and certainty. This mechanical anticipation of favorable conditions may be illustrated by assuming an incisor to be moved in a crowded arch by any means applied by a plate rigidly embracing the bicuspids and canines, when a certain force in a certain time may complete the operation; but were the plate either abolished, or its symmetrical halves partly independent and free to move relatively in the plane of the arch, less time and force would suffice; and, furthermore, if its halves tend but slightly to separate by an elastic spring reaction, many cases will require very much less time and force to be exerted on the tooth. The action thus stated in its simplest form is obvious from *a priori* considerations, but was observed, it is believed, for the first time by a singular accident.

"Soon after the introduction of vulcanite my father was employing a plate of that material to move an incisor by the swelling of wood. Successive increments of force were resisted until not only was it suddenly in position, but other front teeth were found slightly separated where previously in overlapping contact, the wood (being nearly on the median line), by lateral expansion, having split the plate down the center. In this instance, as will often be the case, previous 'expansion of the arch' by the means usually applied was

certainly not indicated, and therefore not resorted to, although just the slight amount of spreading required was prevented by the rigid construction of the plate. A conviction of this led to a particular method of treating various irregularities, which, as anticipating changes common to them—usually expansive,—has been called, somewhat indefinitely, an 'expansion treatment;' and whose adoption has been abundantly justified by experience.

"The troublesome and delicate operation of 'expanding the arch,' as usually performed, if attempted by the ordinary 'jackscrew' direct, must be accomplished before other regulating action can generally be commenced, and may then prove to be either excessive or unnecessary. The screw is applicable, with care, to severe contraction (though inferior to other means); but undivided plates, however thin and elastic, or hinged plates, however actuated, have not the freedom of movement and adjustability desirable; and the screw is entirely unsuitable for a split plate.

"The little device my father calls an 'expansion plate,' whether used for direct expansion or not, is intrinsically of extreme simplicity, while of complex regulating action, comprising a means easily embodied in any plate of conveniently permitting or assisting (instead of hindering or preventing) during regulation, the inevitable changes of the arch naturally accompanying it, and supplementing ordinary expedients with an expansive characteristic. Its distinguishing function depends on the principle of permitting a relative motion, or maintaining a particular controllable reaction, between two semi-independent parts, usually its symmetrical halves.

"If required, any force, however small, is sufficient, if exerted continuously over a certain distance, with not too rapidly diminishing intensity. Mere repulsion, however, between two points on a split plate, is an unstable system, and uncontrollable. Allowing a certain freedom of motion, means must be provided for restraining it, and maintaining by a yielding guidance any desired degree of parallelism.

"Difficulties attended the first realization of these conditions; but it is found that a wire spring of certain form, if a constructive part of the plate, will itself meet all requirements.

"Modifications of the arrangements found most convenient and satisfactory are exhibited,—after actual use, and in different stages of construction.

"The perfection of the model must be insisted upon, as an entire plate may fit well and securely, and yet both its halves be so loose when divided as to be useless; while, on the other hand, the halves of a split plate may be easily fitted, which before division could not possibly be inserted. The best impressions have been obtained with the preparations of gutta-percha or ballata gum, no other material affording with ease the absolute fit essential for a split plate. Their physical property (when in good condition and at the right temperature) of being elastic and recoverable to rapid changes, reproducing, if inserted slowly and removed quickly, the most intricate undercuts just sufficiently—and affording by the slight contraction in cooling just enough shrinkage—for a thin hard rubber copy to fit tightly. A delicate and elastic vulcanite plate from a good gutta-percha impression—if the model be vul-

canized upon direct, and not touched to accentuate undercuts or correct imperfections—will generally spring over the teeth with so absolute a fit that its removal may even be embarrassing; but until divided its insertion is not usually attempted.

"Trials of the metals and their alloys proved the superiority for springs of apparently so undesirable a material as steel.

"The almost insuperable difficulty of satisfactorily tempering bent soft steel without deformation of shape was obviated by the use of pianoforte wire, as possessing every uniform texture, temper permitting it to be fashioned and used without heating, and a surface hardness and burnish which greatly tend to its preservation. To coat this wire with other substances was found unnecessary and undesirable. The behavior of steel to the fluids of the mouth is such that, if hard and bright at first, and continuously immersed in average saliva, it generally assumes a black polished surface, the smooth, fairly-adherent tarnish being apparently insoluble. A diameter of between three- and four-hundredths of an inch (about 0.035 inch) is most suitable, as of this a convenient length of from one to two and one-half inches exerts an appropriate

Fig. 11.—Method used to expand upper arch by Coffin.

Fig. 12.—Lower appliance.

tension in average cases. The force, varying inversely as the length, may be thus determined within those limits, beyond which a different size is required. Figs. 11 and 12 will give a clear idea of this appliance.

"Great credit is due, for working out certain details of the expansion plates, to Peter Headridge, of Manchester, for many years assistant to my father. This gentleman even obtained a patent for some constructive particulars, which, however, he very advisedly abandoned. The curious are referred to specification 1101, 1869.

"In final justification, the advocates of a method they find to simplify, and trust may extend, the treatment of irregularities appeal to their record of results, which—of whatever real importance or value—would have been difficult or impossible to otherwise attain; and have ventured at such length to detail their procedure, for confirmation or criticism by others.

"The paper was illustrated by more than five hundred old, regulating plates, which had been actually used, about four hundred being 'expansion plates,' upper and lower, symmetrically and unsymmetrically divided, of which nearly two hundred were 'simple expanders,' some two hundred embodying

other regulating devices with 'expansion;' the remainder showing the application of pianoforte wire in ordinary plates for general regulating purposes.

"There were also specimens, with demonstrations, showing at different stages details of their mode of construction.

"The models exhibited in the Museum of the Congress, at Burlington House, of forty typical cases (recording by three or more casts to each the condition before, during and after treatment), were classified as illustrating—

1. Expansion auxiliary to ordinary regulating.

(a) In simple crowding.

(b) For rotation and alignment.

2. General expansion.

(a) For operative treatment of caries.

(b) For misarticulation.

(c) Versus extraction of misplaced teeth.

(d) For prominent incisors.

(e) For contracted, narrow, or misshaped arch.

3. Applications of steel wire to every kind of ordinary regulating.

(a) Alone, without plate or accessories, for alignment or rotation.

(b) Combined with elastic ligatures.

(c) With an ordinary plate for moving, shortening, lengthening, and rotating teeth.

4. Combinations of the above.

John Stockton Hough in the *New York Medical Record,* 1873, on *The Laws of Transmission of Resemblance from Parents to Their Children* claims that "the question of resemblance of children to their parents is one which many ancient and a few modern authors have found a field for much close observation and profound philosophy, carrying their discussions and deductions to all possible degrees of differentiation and detail. Some of their reasons and conclusions as to causes are scarcely plausible, but many of them bear evidence of close observation and careful consideration, for modern research has in several instances discovered proximate causes which fully corroborate these ancient opinions.

"It is the object, then, of this paper to bring before the reader such facts as are at hand to determine the general laws which are brought to issue in the following questions:—

"1. Do children derive their resemblance and inherit diseases more frequently or more easily from their mothers than from their fathers?

"2. Are males more apt to inherit the diseases of their mothers, and females those of their fathers; or is the reverse the case?

"3. What are the laws of physical and physiognomical inheritance?

"4. Is there any constant relationship between the physiognomical resemblance of an individual to an ancestor, and the likelihood to the same constitutional affections, or the reverse?

"The various aspects of resemblance by relationship are as follows:—

In General.—"1. Children resemble their mothers more than their fathers.

"2. Males resemble their mothers, and females their fathers.

"3. When children do not resemble their parents, but their grandparents, males resemble their maternal grandfather, and females their paternal grandmother.

Exceptionally.—"1. Children resemble their fathers more than their mothers.

"2. Males resemble their fathers, and females their mothers.

"3. Male resembles paternal grandparent, female maternal grandparent.

"4. Offspring resembles male by whom female was previously impregnated more than its natural father.

"It seems therefore from all authorities cited to be pretty generally believed that mothers impress their children of both sexes with their physical and moral peculiarities, their constitutional tendencies and hereditary diseases and defects; in short, a general resemblance more marked than that derived from their fathers; and it is not at all surprising that this should be so, for the child is for a considerable period, amounting to at least two years, under the exclusive control and influence of the mother and her varying physical condition during this time."

"In the first place, it may be well to inquire, when and where either parent begins to impress the product with a resemblance of themselves. For convenience we may divide the time and place of impression into four parts, viz.: 1. Impression on either element before fecundation. 2. Impression from the instant of fecundation until the product leaves the Graafian follicle. 3. During gestation. 4. During lactation. At each one of these periods the ovum or product of conception usually receives impressions, but most in the second, or indeed principally there, as some authors have it, for they say that both resemblance and hereditary disease are communicated during this period. Constitutional diseases and peculiarities are probably communicated during this time, though the period of gestation must be reckoned to have great influence on the tastes, inclinations, and qualities of the physical and mental faculties.

"It is quite probable that the ova of the female have an initial existence, as primordial cells or germs, at a very early period in the life of the child, and are in some degree capable of receiving and retaining impressions which may influence the products derived from them.

"On the other hand, the spermatozoa are probably not in a condition (if indeed they have an existence) much before puberty to receive or retain the result of impressions made upon the man. So then, before impregnation, the female element has, in all probability, been subjected to the varying physical conditions of the woman for a much greater length of time than the male element has been to the varying physical states of the man; and the former is, moreover, much more susceptible to such impressions than the latter. Some may think that the ova are not susceptible of being influenced by such methods as I have suggested; to these I can only point to the great difference in appearance, constitution, viability, tastes, and inclinations of children by the same parents, while twins are proverbially alike in some one if not all these particulars.

"We conclude, therefore, that there are few, if any, physical, moral, or mental acts of a woman's life that are not without some influence, however inap-

preciable, on every child which she may subsequently bear. And every succeeding child is influenced by the impressions left on the maternal organism by each and every preceding child, though they may all have been of the same father, and this influence is increased with the number of fathers. This brings us to the subject of resemblance of a child by a second husband to the first, which is not within the limits of the subject under discussion.

"After or at the time of impregnation, the father begins to exert a combined influence with the mother, though this influence is much less considerable than that of the female, for in addition to the influence exerted before impregnation, she has begun a new process, which only ceases at the completion of the term of gestation. During lactation the child is impressed in some degree, however slight, by the varying conditions of the mother. Through this source it may imbibe cachexias, diseases, tastes, and inclinations. Indeed some writers have made this an argument against the use of the milk of the lower animals, lest the child should be brutalized by such food. Tupper contends that children are even educated in their mother's milk.

"Every child a woman bears inoculates, so to speak, her constitution with some of the peculiarities of the father of the product; and, other things being equal, it is probable that the greater the number of children the greater will be the impression made upon her system by the husband, until she will finally come to resemble him in some degree at least. This influence is probably greater in the cases of gestations with daughters than with sons, for three reasons, viz.: 1. The father's influence begins earlier in the case of female conceptions, as the ovum is fecundated at an earlier period of development. 2. Female fetuses sap the vitality of the mother more than males. 3. Daughters resemble the father more than sons. From these reasons, then, it is only fair to infer that a woman who had borne a certain number of daughters ought to resemble their father more than after bearing the same number of sons. The husband will therefore lose a part of his individuality, or rather his wife will have acquired a share of it. If this be true, the younger children ought to resemble the father more than the elder; and, if the mother's system can be inoculated with his defects and diseases, even though they be constitutional, as is certainly the case in syphilis, it is only fair to infer that the younger children would be more likely to inherit a predisposition to these affections than the elder and consequently have relatively a lower viability."

During the convention of the Southern Dental Association, 1874, the question of *Irregularities of the Permanent Teeth,* their causes and treatment was considered by a great many dental practitioners and the discussion will undoubtedly prove interesting in illustrating the general thought of the time.

J. S. Knapp, Pennsylvania Journal of Dental Science, Vol. 1, 1854, page 449: In opening the discussion, said that the causes of irregularity have, to some extent, been touched upon in the discussion of the deciduous teeth. He thought that a premature extraction of the deciduous teeth led to a contraction of the jaw, and thus often produced very troublesome irregularities.

"In correcting irregularities great care should be taken, and the pressure should be as direct and regular as possible. This will bring the teeth which are

out of line gradually into place. When the incisors project so much over the teeth as to cause a deformity, it is much more difficult to draw them into a normal position, than it is to spread the arch if too much contracted. It is not only the difficulty of getting them in place that makes the operation so objectionable, but they must be held long enough to allow a deposit of bone to be made in order to make the operation successful. If plates are used, great care should be taken that they fit accurately to the teeth, or the gum will become inflamed; if this should occur, nitrate of silver or iodine should be used as a remedy. If ligatures or rubber rings are used, they should be kept from slipping up on to necks of the teeth, thereby preventing inflammation, or a premature absorption or recession of the gum. By observing these principles some of the dangers attending this tedious operation will be avoided, and the results will be most satisfactory."

Dr. J. R. Walker in the same journal said "he used rubber rings first to get them into line with each other, and then constructed a scaffolding on the boy's face in order to get a proper purchase to bring them into a natural position. This consists in placing a wooden appliance, carefully fitted to the teeth, across them in front, the ends extending beyond the mouth on either side, and attached by elastic bands to a pad on the back of the neck. In this way he succeeded in righting this most disagreeable wrong in three months' time. He uses ligatures and rubber rings in regulating teeth, and when a plate is needed he uses aluminum in preference to any other material."

"*Dr. W. H. Morgan* uses the jackscrew, and approves of it as an appliance for regulating teeth. He described a case in which he used jackscrews imbedded in a rubber plate, the heads so arranged as to bear against the teeth to be moved, and then by a turn or two every day spread the arch successfully.

"*Dr. S. Welchens* desired to speak more particularly upon the subject of what is termed heroic treatment of irregularities. Believes in moving teeth as rapidly as possible, and in such treatment is not at all solicitous as to the age of the party operated upon. Care should be taken, of course, not to produce undue inflammation in patients a little advanced in life. Heroic treatment is safer and less liable to bad results in the case of young and healthy persons, when the vigor of youth will effect a speedy and successful recuperation. In every case care should go in hand with intelligence and good judgment."

S. H. Guildford in the *Pennsylvania Journal of Dental Science*, 1874, in an essay on *Irregularities of the Teeth and Their Treatment*, said "The causes tending to produce, and the means applied to prevent and correct irregularities of the teeth, have received some attention from us as a profession, but they have not, I believe, received nearly the same attention which their importance demands.

"While we trace the filling of teeth and the wearing of artificial substitutes back a couple of centuries, we have nothing to lead us to believe that great irregularity was known very long ago, and hence no cause excited for its correction.

"The primitive mode of life had much to do with this; but modern civilization, or civilization as it has existed within the past fifty years, and more par-

ticularly within the last twenty, has made sad havoc, not only with the tissues of the teeth, but with the time and manner of their eruption and their respective positions in the dental arches.

"Our present manner of living, which induces, indeed almost compels, us to avoid eating those portions of food which were designed by an all-wise and beneficent Creator for building up and sustaining the framework of our bodies, and further keeps us from giving the dental organs the proper amount of activity and work to insure their strength and healthfulness, is the primary cause of irregularity among them.

"Were there a sufficient proportion of lime salts in the alveolus and tooth substance, placed there in the economy of nature by the eating of proper food, this same food giving health and tonicity to the blood, strength to the nervous system and density to the muscles and soft tissues, and did we at the same time give our teeth enough hard work to do, it is safe to say that in the second succeeding generation irregularity would be unknown and decay almost so.

"We as a profession, like the medical faculty, are gradually working up to that higher standard, which has for its object the prevention, rather than the cure, of disease. Let us press faithfully on toward this mark, and while we go let us endeavor by our best efforts of mind and body to relieve and remedy defects as they now exist.

"Among the things that are most usually regarded as the causes of irregularity, and so laid down in the textbooks, are the too early extraction, or long retention of the temporary teeth; disease of these teeth, resulting in abscess and disintegration of the alveolus, and blows or accidents, either to the temporary teeth or to the permanent ones in the course of their eruption.

"Among those cases to be begun before all the temporary teeth have been shed, may be mentioned: the protrusion of the lower jaw, to be corrected as soon as possible by bandages; and the throwing out or in of a permanent tooth that has by some means been moved out of position and shuts respectively outside or inside the opposing arch.

"Among those, however, most usually met with, are protrusion of the lower jaw, thus allowing the lower teeth to bite outside the upper ones; a narrow and contracted superior arch, very much resembling a "V" with the angle of the letter resting between the central incisors; the superior incisors falling inside the lower arch, and the cuspids in consequence protruding from the alveolus outside of their proper arch, probably resting upon the laterals and first bicuspids, giving an undue prominence to that portion of the upper lip just over them, and producing a general disfigurement in the person's appearance.

"Unless all these conditions are met in the beginning, it will be useless for the operator to waste his time and the patient his money in making any attempt at improvement. The means employed from time to time for the correction of irregularities have been varied and numerous, the prime factors in such cases, as in physics generally, being the inclined plane, the wedge and the screw.

"The inclined plane for moving the upper incisors from within outward, was probably used at a very early period, and continues today to be one of the best means employed for that purpose. The wedge, or the principle of it, was

used in spreading the teeth apart, thus widening the arch, or in producing space generally between two points. The screw was used for the same purpose, where greater power was needed, or where it could be more advantageously brought into play.

"The three motions to be produced in treating all such cases are expansion, contraction and rotation, or, if you please, tension, traction and torsion. Produce any or all of these motions as the case may require, and you have all that you will require to correct the worst case of irregularity that may present itself.

"What then, let us inquire, are the best means of producing these various motions, so that we may apply them to particular cases?

"Tension, or expansion, of the dental arch, or of several teeth on either side, was formerly, before the general use of rubber, produced either by a metal plate extending across the mouth, with slots filled with fusible metal opposite the teeth to be moved or instead of the fusible metal having pieces of wood which, when moist, would swell and expand, or it was produced by clasping the teeth to be operated upon and pressing them apart by means of a jackscrew extending across the arch of the mouth.

"Since, however, soft and hard rubber have come into general use, they have very much superseded metal for this purpose.

"To produce this expansion of the arch easily, rapidly and with comfort to the patient, it is only necessary to prepare a hard rubber plate closely fitting and covering the hard palate and lingual surfaces of the teeth to be moved, and inserting wooden pegs in holes drilled for the purpose in the plate just opposite the teeth. These pegs placed in the mouth dry and tightly fitting, will when wet expand and press the teeth; not only that, but you gain the benefit of the elasticity of the rubber plate. The advantages of such an appliance are, that it is very little in the way of the tongue; has nothing hard in its composition to injure the teeth; is easily removed by the patient for cleaning; does not show from the outside, and is thoroughly effective. I have been extremely successful in the use of these plates for the past eight years.

"Torsion, or rotation, frequently necessary, is perhaps one of the most difficult duties in correcting irregularity. The superior incisors very frequently require it, sometimes the canines and bicuspids, and not infrequently the lower incisors call for its performance. This may be done in several ways.

"One way is to tie a loop with silk or strong gilling twine around the tooth, over the opposite angle, attaching a rubber ring to it and fastening it at some point far enough away to produce very strong traction. This has a tendency to rotate the tooth.

"Another way, which was first used by Dr. Magill, of Erie, Pa., consists in fitting to the tooth a metallic band or ring and to the outside of this soldering a bar of platina-gold in such a way that when in position this bar will be at an angle of about forty-five degrees to the teeth on the side to which it is to be attached.

"When made, the band is fitted to the twisted tooth with ox. chl. zinc and the bar sprung down and tied to the second or third tooth from it.

"Here the elasticity of the gold bar will usually very quickly produce the desired result.

"It is an old saying that 'an ounce of prevention is worth a pound of cure,' and on this principle, I feel convinced, from many years' experience and observation, that if we can in any way prevent or arrest the course of irregularity in teeth, it should be done. That this may be done in very many cases by the judicious extraction of the first permanent molars, I most firmly believe."

George T. Barker before the same society discussing Guilford's paper stated:

"He was glad to find his views, as expressed two years ago, at Gettysburg, on the extraction of the six-year molar, so well sustained here. He held that the structure of the human body is becoming rudimentary, and that as a rule the jaws are becoming more contracted, so that there is not room enough for thirty-two well developed teeth. We should preserve the symmetry of the features and try to develop a good regular denture. This could be done only by extracting the six-year molar when the patient is yet young. In correcting irregularities he always secured the cooperation of the parents as well as the child, and is careful to let them know the probable cost of the operation, as well as the inconvenience and pain it may produce. He uses rubber rings and ligatures mainly, in his treatment of irregularities, and thus obviates the use of plates. In extracting for such correction he prefers the removal of the six-year molar."

Before the Association of the Pennsylvania College of Dental Surgery, *Dental Cosmos*, page 239, 1874, in a lengthy oral address upon *The Old and New Methods of Correcting Irregularities*, Barker stated "that the old methods were intricate, the appliances worn with great discomfort, and that attempts to regulate were something that every operator avoided if possible, because attended with a great amount of labor, the compensation being slight. He deprecated the use of plates and the inclined plane, claiming that by such practice the proper articulation was likely to be destroyed. In all cases before commencing the operation, it is necessary to have the patients not only willing, but anxious that it be done, for then they do not object to the discomfort necessarily attendant. Whenever a tooth is moved there must be absorption and corresponding deposition of new tissue, and this is best brought about by having the will of the patient enlisted, such state being conducive to nutrition. He regulates by elastic ligatures entirely, and expects success in three or four weeks. Most operators have difficulty in preventing ligatures from slipping up at the neck of the tooth and causing irritation. This difficulty he obviates by passing a gilling-twine ligature posteriorly above the basilar portion of the tooth, bringing it anteriorly to about the middle of the labial surface; here it is tied in a surgeon's knot (by passing the end of the string through twice); it is then carried posteriorly to a point midway between the basilar ridge and cutting edge, the ligature being brought over the anterior face, when it is tied with the knot first made. This is, to all intents and purposes, two ligatures joined at about the center of the labial surface, and, as each holds the other in position, there is no possibility of either of them slipping. If it is desired to rotate a tooth, the knot may be placed on one side or the other as may be necessary to apply the force in the proper direc-

tion to produce the desired result. The elastic band is attached to this double knot and passed anteriorly to those teeth that are outside, and posteriorly to those that are inside the arch. He attaches the band to two or three other teeth, that their resistance may be greater than the force required to move those teeth which it is desired to regulate. A number of models of cases that were successfully treated by him in this way were shown, and the *modus operandi* explained at length."

A. C. Hawes, before the First District Dental Society, New York, 1874, (*Dental Cosmos,* page 426) described a simple appliance he had devised for bringing central incisors into line when rotation is required. "From the diagram the principle will be easily understood. (Fig. 13). (*a*) The centrals to be rotated. (*b*) The bolt passing between the teeth, its head resting against the labial surfaces, and the shaft made to screw into the short bar. (*c*). With this simple appliance he had succeeded admirably, without encumbering the mouth with a large and troublesome apparatus."

J. R. Walker in the same journal, page 490, "spoke of a case where the teeth in the lower jaw had fallen back by reason of the loss of the six-year molars, so that the upper projected half an inch, while the teeth were so short that it was impossible to get a hold on them. He had used an appliance consisting of a

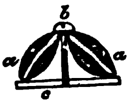

Fig. 13.—Hawes' method of rotating incisors.

stick across the front teeth, the ends of which were attached to elastics which went behind the neck, and succeeded in drawing the teeth back in three months."

Alexander Ogston in the *Glasgow Medical Journal,* 1874, considered a subject which at that time attracted but little attention but today may be considered of the greatest importance: *"On Congenital Malformations of the Lower Jaw."*

"The difficulties inherent in the subject are twofold. In the first place, cases of these malformations are very rare, forming a marked contrast in this respect to those of the upper jaw, so fully studied and so usual in the experience of every surgeon; and, in the second place, the cases which have been put on record by no means harmonize, at first sight, among themselves, and have even been deemed capable of very different explanations.

"The immunity of the lower jaw from deformity, already alluded to, seems to be as marked a feature in its later as in its earlier stages of development. It is found that irregular position of the teeth (a mere mechanical accident), and the formation of tumors, are equally common in both jaws; but what may be called vital processes, such as the malformations of congenital syphilis, and the deformities specially connected with mental development, are most marked and most frequent in the upper jaw.

"The congenital malformations, which are alone treated of here, exist in various forms and degrees."

Ogston divided the subject as follows:

"Nondevelopment of the inferior maxilla.

"Excessive development of the lower jaw.

"Congenital smallness of the lower jaw.

"A. Congenital smallness of both halves.

"B. Congenital unilateral smallness of the lower jaw.

"Congenital dislocation of the lower jaw.

"The cases adduced above, which are all, or almost all, that have been recorded, are too few in number to enable any very valid deductions to be drawn. So far as may be judged from them, however, congenital smallness of the lower jaw does exist, though rarely, and is usually conjoined with symmetrical deformities elsewhere, such as cleft palate, etc. In some cases the jaw so affected carries a diminished number of teeth, in others this is not the case, and at all events the absence of some of the teeth is more probably a consequence of the cause which has produced the smallness of the jaw, than itself capable of explaining the origin of the smallness. It seems further justifiable to conclude that, where the subjects of this deformity survive to adult life, they are not unlikely to become affected by such superadded deformity.

"Having now given as complete a résumé as lies in my power of the various congenital malformations to which the lower jaw is subject, and interpolated, where it seemed necessary, explanations sufficient, I hope, to have rendered clear the views of these which we seem justified in adopting, it only remains for me to embody in a series of propositions the conclusions we seem warranted in drawing from our present knowledge of these deformities. These are as follows:

"1. Congenital deformities of the lower jaw are very rare.

"2. Nondevelopment of the lower jaw has been recorded in animals, but never in man.

"3. Excessive development of the lower jaw appears to occur, though very rarely, and minutely recorded cases of it do not exist.

"4. Preponderance of size of the lower jaw has been observed as the result of deficient development of some of the other facial bones.

"5. Congenital smallness of the whole lower jaw occurs, and is generally associated with symmetrical deformities elsewhere.

"6. Congenital smallness of the whole lower jaw may lead in after life to acquired deformities of the bones of the cranium and face.

"7. Congenital smallness of the lower jaw has been found in one case with, and in two without, formation of the temporo-maxillary articulation of the same side, and coincided in all asymmetry of the cranium.

"8. Congenital dislocation of the lower jaw is said to have been met with in a single imperfectly recorded case."

S. James A. Salter in his book *Dental Pathology and Surgery,* 1875, devotes considerable space to *"Irregularities in the Position of the Teeth, Causes, etc.,"* and from it we gain a great deal of knowledge as to the treatment and theory

of this branch of dental science, during this interesting period of orthodontic growth. This work gives us the best analysis of this subject, in America, during the seventies, and demands careful examination and study.

"Irregularities of the teeth, as regards their relation to each other and to the laws containing them, constitute some of the most important considerations in the practical treatment of the teeth, and they are not without interest theoretically.

"Irregularities of the temporary teeth are uncommon, and are not of much importance. The incisors sometimes have a distorted position, but the commonest form of irregularity in the teeth of the first set is that which is relative in the two jaws. It is not very rare in families where there is a strong tendency to what is known as an 'underhung bite,' for the temporary incisors, or even the canines of the lower jaw, to project beyond those of the upper. And though this may not be attended by any irregularity of the relative position of the teeth in either jaw, it still constitutes a serious irregularity of the teeth as taken collectively.

"These irregularities of the temporary teeth may not require immediate interference, but they indicate the propriety of most careful superintendence during the advent and progress of succession.

"Irregularity of the teeth appears to be one of those conditions induced by artificial life, and progressing in degree during the lapse of time in successive generations. It is almost unknown among the lower animals in a wild state; but it has been induced in some through domestication.

"This subject may be treated with almost endless extension, and with profuse illustration, as the conditions of irregularity are almost without limit in their variety, and may be complicated in cause.

"I propose to consider them here briefly and practically, and principally by illustrative cases that have occurred in my own practice.

"The causes of irregularities may be (1) congenital and hereditary, (2) the prolonged retention of temporary, (3) accidental mechanical influences, (4) disproportion of the size of the teeth and jaws, (5) faulty development of the jawbones.

"There are few conditions in which hereditary influences are more manifest than in the irregularities which occur in the teeth; and these show themselves often in minute particulars, and are displaced with distinctness by collateral relations. The prolonged retention of temporary teeth is frequently associated with irregularity in their successors or their permanent neighbors, and is probably often the cause of such irregularity; though perhaps the imperfect or tardy growth of the permanents may be at least partially the reason why temporary teeth are so retained. Accidental mechanical influences, such as thumb-sucking or hypertrophy of the tongue, will cause certain irregularities. But by far the most common cause of irregularities in the teeth is their being disproportionately large in comparison with the jaws. This is a condition which has been progressing in development for a long period of time and very many generations, and appears in some way dependent on civilized life. The disparity is such as to lead to the crowding of the teeth so constantly seen, and

which is sometimes so excessive as to altogether exclude some member of the dental series from eruption, and hold it permanently impacted in the substance of the jaw.

"This condition is not infrequently induced by the premature extraction of the temporary teeth, which permits contiguous permanent neighbors to approximate each other to the displacement or partial exclusion of the successor of the extracted tooth.

"Malformation of the jaws is much less common, and is only certainly displayed in some peculiar irregularities, as in the V-shaped jaw.

"In considering irregularities of the teeth in regard to their treatment, they may be divided with much practical advantage into (1) simple (2) compound or contingent.

"Simple irregularities are those in which the misplacement is absolute as regards the jaw affected, and independent of the position of the teeth in the opposite jaw. They may affect both jaws in the same individual, but they are uninfluenced by each other.

"Compound irregularities are contingent on the position of the teeth of the opposite jaw, as to cause or maintenance, and are dependent on the 'bite.'

"The importance of these distinctions will be manifest in considering the treatment of these cases. In curing irregularities it will be necessary to remove all obstructions which prevent the teeth from assuming a regular arrangement; and it may be necessary to apply mechanical elastic force to complete that result. Both these elements of treatment may be requisite in a single case. Again, there is a peculiar method of applying mechanism where no force is involved, namely, in those cases in which the irregularity is contingent on the bite, and where the closure of the mouth causes its maintenance. In such cases the jaws must be kept apart during treatment, and this is accomplished by the passive mechanism of gagging.

"Very much depends on the age of the patient when the irregularity comes under treatment. For instance, where it is brought about by crowding, the mere removal of some tooth or teeth in a young patient may allow the remainder to assume the natural arch, and this they will generally do without assistance; whereas the same condition in an older patient will require mechanical pressure to place the teeth in proper range, and it may be necessary to maintain them in this position by similar means for a considerable period, as when once firmly established they have a tendency to return to their original relations."

The question of extracting teeth to correct irregularities seems to have been a very potent problem even at this period and Salter's views will give us some idea as to the controversy existing even then.

"It has appeared to me that this subject may be conveniently treated by the consideration of typical examples of irregularity where the upper canine tooth, from insufficient room, makes its appearance high up, and in front of the range of contiguous teeth. I refer to this form of irregularity, first, not only from its frequency, but because its consideration involves many general questions of importance bearing on the whole subject. It may arise from the premature

removal of the temporary canine tooth, thus allowing the bicuspid and lateral incisor to approach close to each other.

"This condition usually manifests itself between ten and thirteen years of age, and, if uncomplicated, it is readily cured by the extraction of a tooth behind the coming canine; and in the simplest cases the removal of the first bicuspid, effects the remedy at once. Circumstances, however, may suggest the desirability of sacrificing another tooth, the second bicuspid, or even the first molar; and this point requires careful consideration. And it should further be remembered that much may be done by nature, through the expansion of the jaw itself; and this is especially the case where the permanent teeth make their appearance very early, and at a time when the jaw, from the age of the patient, may be supposed to be too soon invaded by its large and many occupants. I have sometimes known bicuspid teeth removed to make room in young patients with much crowding, when afterwards it has been apparent that such a proceeding was unnecessary,—the jaw growing to such an extent that considerable spaces were developed between the remaining teeth—spaces which in the aggregate would have accommodated the teeth that had been extracted. It is a question, therefore, with young patients to consider how much may be done by nature in time, before a sacrifice is entailed which can not afterwards be remedied.

"In estimating which of the three teeth (first or second bicuspid, or first molar) should be extracted in any given case, many points arise which should be carefully balanced in the mind of the operator before he makes his selection. The respective value of the teeth must be considered as features, as organs of mastication, and in relation to their prospective durability and their soundness at the time. These are all important points for consideration, irrespective of he cardinal question as to which tooth would, by its removal, best effect the required object, furnish the needed room, and allow the misplaced anterior tooth or teeth, to range in proper order with the others. Unquestionably the bicuspid teeth are superior as features to the molars; indeed, the farther forward in the mouth a tooth is situated, the more does it modify the form of the lips, the more is it seen in expression, and consequently the more would its absence be remarked. It must be recollected, however, that there are two bicuspids, so much alike that when one is lost the other takes its place as far as appearance goes. As an organ of mastication a molar is of greater value than a bicuspid. The present soundness or otherwise of the bicuspids and molar is a question of the greatest importance, and must often decide finally and peremptorily the question under consideration. Provided the loss of either a bicuspid or a first molar would give the necessary space with equal ease and certainty, or nearly so—one being carious and the other sound—there can be no hesitation as to which should be extracted. The decayed tooth should be taken out, and a double good will thus be effected, the regulation will be achieved, and a source of future or perhaps present pain will be removed. It must be recollected, however, that it will take a far longer time for the crowding of the canines and incisors to obtain relief by the removal of a molar tooth than by the loss of a bicuspid; and in patients who have reached some fourteen or fifteen years of

age, or in whom the irregularity has existed for some time, it may be doubtful if the loss of a molar will extend forward the required relief. And this leads to the consideration of another very important point. The 'te' of the bicuspids in the two jaws may be interlocking; the cusps of the lower bicuspids may so abut, when the mouth is closed, upon the posterior aspect of the cusps of the upper bicuspids as to prevent the latter from moving backwards after the removal of the first molar; and thus, though the room may be furnished, the crowded upper front teeth are mechanically prevented from obtaining the benefit of it. The operator, therefore, should well look to this point before deciding on the removal of a molar. I urge this, not on theoretical grounds, but because I have more than once seen a molar removed under these circumstances; and, the bite keeping the upper bicuspids immovably forwards, no improvement in the irregularity took place. Finally, the question of relative prospective durability, as between the bicuspids and first molar, supposing each to be sound, is a point the importance of which can not be overestimated. This matter is not so easily decided by the statistical records regarding the decay of the two teeth as has been imagined. No doubt first molars are more prone to decay than bicuspids, and it may be prognosticated as probable that at the time any particular first molar is cut its term of soundness will be shorter than that of any particular bicuspid, when it first comes into the mouth. But that does not state the case fairly. The question is, which tooth, supposing both to be sound at the time when regulation is required (say at about twelve years of age), has the best prospect of prolonged soundness and usefulness? It should be remembered that a first molar tooth at that time has been in the mouth some six years and if then sound, it has for that long period resisted the influences of decay. The bicuspid, though also sound, has only been exposed to like influences for a year, or a few months. The existing evidence therefore, though negative in its nature, is, as a matter of probability, altogether in favor of the molar on the score of prospective soundness; and my own experience is that if a first molar is free from decay at twelve years of age, it is nearly as likely to remain sound as any other molar; whereas no such estimate can be formed of the prospective durability of a bicuspid that has been in the mouth only a few months. This is the real question as between a sound bicuspid and first molar at the usual time for removing one of them to make room, and it is in favor of the retention of the molar.

"I would, therefore, say, as a summary of these arguments: Provided the removal of either tooth would be equally efficacious, or nearly so, remove a decayed tooth rather than a sound one; this will lead to the very frequent extraction of the first molar. If both the bicuspids and first molar are sound, extract one of the former; and the regulation, though not more effectually perhaps, will be more speedily accomplished than by removing the molar.

"The foregoing observations have been written with special reference to the upper teeth, but they may be applied to those of the lower jaw. The greater durability of the inferior bicuspids, however, and the more easy cutting and more forward position of the lower wisdom-tooth which result from the removal of a first molar, would tend to balance more evenly the claims of the two teeth respectively; still, where both are sound at twelve years, I would remove a bicuspid

and retain the molar. As regards the first and second bicuspids respectively, the removal of the former I consider preferable.

"This crowding of the canine tooth in the upper jaw upon the lateral incisor, entailing the loss of a tooth to remove unsightly irregularity, not infrequently involves another question of much nicety and requiring a judicious balance of opposing arguments. The question I refer to does not relate to the loss of a bicuspid or a molar, to make room for more forward teeth, but it is this: In a confirmed irregularity in a patient of more advanced years, when posterior room can not be expected to allow the canine and lateral incisor to range in proper arch, the disfigurement being great, which of the teeth in question ought to be sacrificed? Such cases constantly occur.

"An overlapping and crowding of the upper incisor teeth is not uncommon, and may exist in various degrees and forms. The accompanying illustrations are of a sufficiently characteristic example (Fig. 14), and show the treatment which rectified the irregularity in this instance. The left central incisor projected beyond the normal arch, while the right central and both laterals were within it. To obtain room the first left bicuspid was extracted, and then a plate

Fig. 14.—Salter's metal plate, applied to the teeth.

Fig. 15.—Salter's metal plate.

(Fig. 15) was adapted, in which processes *a* and *b* pressed out the in-standing teeth, while a band of hard elastic gold, *c*, drew in the projecting incisor.

"An incisor tooth being twisted and placed more or less across the line of the maxillary arch, is another not uncommon irregularity.

"In contingent irregularities, where the bite is intersecting, or altogether 'underhung' where some or all of the upper six front teeth shut behind the lower in closing the mouth, it will be necessary to adopt the passive mechanism of gagging, either alone or in combination with elastic pressure; for, if the jaws are not separated somewhat, the misplaced teeth are persistently held in their wrong position every time the mouth is closed.

"The gag consists of a little 'cap' (Fig. 16) made to a model of one of the molar teeth, and upon it are soldered thicknesses of metal enough to separate the front teeth; it is made to clip firmly the neck of the tooth, and it remains on permanently. In Fig. 16 the cap is seen embracing the second temporary molar tooth, which is the one I usually fasten it to. When the displaced upper teeth have advanced sufficiently to allow the lowers to shut behind them, the gag

should be removed, and then closure of the mouth completes the cure, by forcing forward the teeth which had been too backward.

"Crowding and overlapping of the inferior incisor teeth is a common form of irregularity. It very frequently occurs as a transient condition in changing the teeth; but, when it threatens to become permanent, treatment should be adopted, either by giving lateral relief, removing a bicuspid tooth, or by extracting one of the irregular incisors, and of these it is usually desirable to remove the most prominent. The gap readily fills up, and the loss of the tooth is scarcely to be observed.

"Separation of the teeth of the two jaws in the front of the mouth, while the molars are in contact, is occasionally met with.

"It may arise from (1) congenital malformation of the lower jaw. It may be induced (2) by contraction of the cicatrix of a burn in the throat, pulling down the front of the lower jaw; or (3) by the protrusion of an hypertrophied tongue.

"The treatment of these cases is tedious and often unsatisfactory. It may be sought to obtain two results—an increase in the width between the bicuspid teeth, and a diminished projection of the incisors and their sockets. The first object may be accomplished more or less by a palatal plate pressing the teeth outwards, the force being established and maintained by the width of the plate

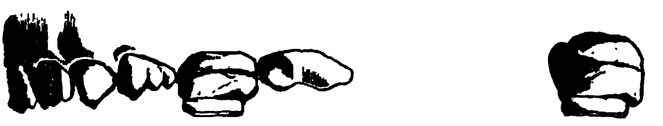

Fig. 16.—"Gag" or crown applied to deciduous molars to open the bite (1875.)

being in excess of that of the interval between the teeth, and the pressure kept up by increasing the width as the teeth yield. This may be accomplished either by a metal plate, or by vulcanite or ivory, with the addition of compressed wooden pegs.

"A plate fastened to the first molar and second bicuspid may be the fixed attachment, from which the force is applied, and this may consist of metal bands extending round the front of the teeth, bent in from time to time as the teeth yield; or, what I prefer, an apparatus such as is here figured (Fig. 17). In this a frame, *c*, fits over the incisor teeth, and from this a spiral spring, *b*, extends to a swivel and screw, *a*. The elasticity of the spring soon brings in the teeth, and it should be tightened by shortening as the case progresses. Care should be taken that the bar across the palate does not obstruct the recession of the teeth and alveoli.

"Transposition of teeth is an occasional though rare form of irregularity.

"Inversion of the teeth is another and very rare form of irregularity."

Potpeschnigg, in the *Deutsche Viertel-Jahrsschrift für Zahnheilkunde,* January, 1875, describes *A Tooth Regulating Machine,* as follows:

"The difficulty often experienced in bringing an upper front tooth from within the normal arch even with its neighbors; the frequent complaints that

children will not wear a machine in the mouth, or with difficulty can be watched, and the circumstance, that for every individual case a new contrivance must be made, led me to the construction of the accompanying machine. (Fig. 18.)

"Description: (*a*) is a well padded leather cap, which embraces the back of the head, and in which is sown firm a little below the external occipital protuberance in the direction of the sagittal suture forwards—a steel splint (1″ wide, 1½″ thick), which ends horizontally in (*b*) half an inch away from the head, and, therefore, can not press the same. To the middle of the posterior border of the cap, at the beginning of the splint, is attached a small brass ring, through which the cord (*f*) runs, passing on either side under the armpits backwards, where the ends are securely tied, making it impossible to draw the cap over the face, (*c*) is a strong elastic bandage to be lengthened or shortened at will, and which prevents any lateral movement of the cap.

Fig. 17.—Another appliance of Salter's w'th spiral springs to retract lower teeth.

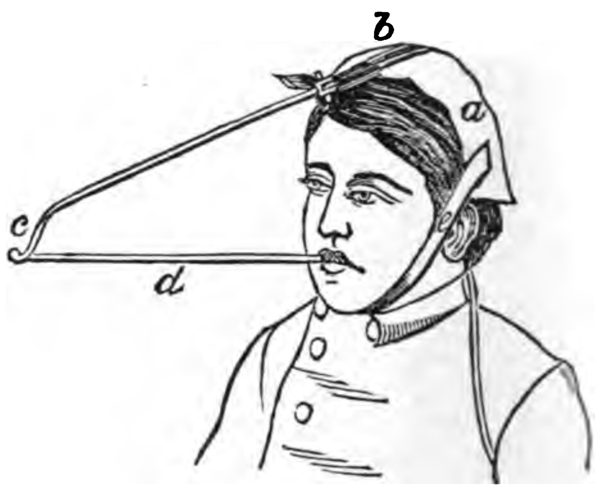

Fig. 18.—Method adopted by Potpeschnigg to correct irregularities of the teeth.

"A round steel rod, the thickness of a pencil, 18″ long is connected at (*b*) to the free end of the splint, through the united ends runs a perpendicular rivet, on which the steel rod turns from side to side. The end of the rod (*c*) is bent upwards. A firm point is now secured opposite the teeth from which a traction power can be exerted on the tooth within the arch, which is effected by means of an elastic ring. This traction acts on the steel rod like a weight suspended at (*c*); that is, it causes at (*b*) a fixture either to the right or left. If now the tooth be embraced close to the gum by the elastic ring, and this is slowly stretched over the end of the rod (*c*), it is possible to move the point (*c*) 90° either to the right or left, and it can readily be fixed at any degree desired. One is consequently in a position to draw the tooth, not only forwards but at the same time either to the right or left. The point (*c*) is so far off, that the patient can look at it without squinting. Unable to do more than point to a result, I now offer the following for consideration:

"1. The traction is constant and can be regulated.

"2. The moving of the tooth ensues without periostitis.

"3. The patient can not interfere with the action except by removing the elastic, which is easily controlled.

"4. The patient can eat, drink, talk, and play about without risk of injury from a fall, as the rod can give way in either direction.

"5. The contrivance is suitable for any case of the kind, as the cap can be reduced by tightening the bandage.

"6. The whole contrivance costs three dollars.

"The boy never complained of headache or pressure, and only once of an itching of the head after wearing the cap four hours."

Felix Weiss, in a series of articles presented in the *British Journal of Den-*

Fig. 19.—Felix Weiss.

tal Science, 1876, under *Notes From a Dentist's Case-Book,* explains the condition of Dentistry then in England, as we can see from some of the following extracts:

"In glancing at the labors of more than a quarter of a century, with all its variety of incidents, experiences, successes, and failures, I feel half inclined, at first, to believe that there is but little that is but really new in our modern treatment of disease, and that our facts, in the main, have during the past fifty years, been but sparingly added to.

"Our daily practice appears at a first glance to be made up of the same cases with some slight modification, the same treatment with perhaps some trifling improvement; and while the whole world goes on repeating itself, we are irre-

sistibly drawn to the conclusion that, after all, we are but as miners turning up the rich soil of past experience, to lay down another layer that an after generation will perhaps exhume; picking out a fact here, and disputing an inference there, but with all making up the bulk of our daily toil by repeating over and over again the same words, giving the same advice, and following out very nearly the same treatment."

Under *"Hereditary Transmission of Peculiarities in Arrangement"* Weiss says: "These may be divided into two classes: 1st. Hereditary variations in the position of the teeth themselves. 2nd. Hereditary variations in the relative position of the superior and inferior maxillæ.

"Under the first of these heads we have a numerous group of cases where irregularities have been transmitted from parent to child, with but little modification, from one generation to another, but they are most of them of so usual a character and so frequently met with they hardly require particularizing here. The crowding of the upper or the lower jaw to the exclusion of one or more teeth, the canine being, perhaps, the tooth most usually thrown out of position. A class of cases in which the removal of a bicuspid or the first molar on each side, at the same time preventing the antagonism of the back teeth, is generally recommended.

"Again, we have peculiarities in the position of individual teeth distinctly traceable to hereditary causes. The overlapping of the central incisors, a distinctive mark, that in one family I am acquainted with, ran through all branches on the female side, and was called, so I am told, from the frequency with which it presented itself, T—y's mark. Two of the sisters I have seen, and a child just cutting her inferior incisors—a case watched with considerable interest.

"Hereditary variations in a relative position of the jaws themselves, although by no means uncommon, is not so frequently met with as the mere irregularity of one or more teeth.

"We now come to a class of irregularities presenting precisely the opposite appearance to those we have been describing. The upper teeth, instead of standing out far in front of the lowers, are inside the inferior circle, giving to the face that expression we are accustomed to see in persons said to be 'underhung.' This is an irregularity met with, if anything, more frequently than that of the opposite character, and although in the generality of cases it is more readily remedied, or at least the appearance improved, it is extraordinary how frequently its regulation is neglected."

"On the Retarded Eruption and the Absence of Permanent Teeth," Weiss wrote:

"Although the usual period for the eruption of permanent teeth may have long passed over, we have no reason to infer that the missing tooth or teeth have not been developed; indeed, in every case that has come under my observation, as far as the twenty-eight teeth of the second set are concerned I have never been able to do more than demonstrate that the eruption of one or more teeth has been retarded. Different individuals may vary as to the time of cutting, and although the molars are the most regular in their appearance, still they may deviate to the extent of fourteen or sixteen months or even longer. We

find in some families an hereditary predisposition to cut the teeth of the permanent set in a particular order, the bicuspids, for instance, coming soon after the eruption of the incisors. We also find an hereditary absence of particular teeth, the lateral incisors, for instance, not appearing until late in life and indeed sometimes not appearing at all until hastened by the wearing of a piece of mechanical work.

"That the temporary teeth may be extracted without occasioning any reduction in the ultimate size of the jaw I think we have plenty evidence to prove, but the early loss of these deciduous teeth to my mind is a fruitful source of irregularity in the coming set. Not only do we lose the directing agent which in many instances guides and controls the coming teeth, but we give the advancing organ increased labor, the bone has to be absorbed and the place which should have been reserved for it is already occupied. This is particularly observable when at an early date, owing to the crowding of the centrals, the temporary eyetooth is sacrificed, a practice I greatly object to. The permanent canine is compelled to take a position outside the circle or so far in the palate as to seriously affect the articulation."

F. H. Balkwill, also in the *British Journal of Dental Science* of 1876, in a series of articles to treat irregularities of the teeth described various *Regulation Plates.* He says:

"A plate was made to cover the palate, cap the molars and bicuspids, and come down outside them an eighth of an inch on the gum. It was not allowed to fill the gap between the left lateral and bicuspid, but at that part the palatal rubber was carried up rather higher than the tops of these teeth in order to carry a hole for a plug of compressed wood. The plate was filed a quarter of an inch back from the right lateral to allow this tooth to move in. (Fig. 20.)

"The elastic rings used were cut from the black India-rubber tubing sold with Maw's feeding bottles for the nursery.

"In order that a frame may act efficiently in a case of any difficulty it is important that it should be firmly tied in the mouth. (Fig. 21.)

"The second bicuspid being chosen as the most convenient tooth for the attachment of the ligatures, holes are drilled through the outside of the regulation plate about a quarter of an inch apart, so as to enter the impression of the second bicuspid nearly at the place to be occupied by the highest part of its outside cusp, that is, in the deepest part of the impression. (Fig. 21, *c c c.*) Fine mohair is passed around the neck of the tooth, and tied tightly on the outside at the margin of the gum in a knot. (Fig. 21, *a a.*) The fellow-tooth on the opposite side of the mouth having been treated in the same manner the loose ends of mohair which have been left about six inches long on purpose are threaded through the holes (Fig. 21, *c c c*) in the regulation plate, which is then slid up the ligatures into its place. The patient is now directed to bite hard; the ends opposite each tooth are drawn tightly, tied, and the superfluous ends cut away. (Fig. 21, *b b.*)

"Before the plate was put into position, however, holes were drilled at the posterior ends on the outside and an elastic ring, made by cutting a quarter of an inch off the black elastic tubing sold with Maw's feeding bottles, tied on at

each end. (Fig. 20, *a*, *b*.) A square-headed peg of compressed wood (Fig. 20 *c'*) was placed in the hole (Fig. 20, *c*), so that in expanding when in the mouth it should drive the left lateral and first bicuspid asunder, and virtually, the bicuspid being supported, drive the lateral towards the central. A ligature was then placed around the canine. This tooth was not fully through the gum, which was therefore slit to allow of the mohair being pushed under it until a firm hold of the tooth was obtained. I may here remark for the sake of young practitioners that this is more easily done than appears probable, as there is no adhesion between the gum or periosteum and the enamel of any tooth.

"The right lateral was a very long and prominent tooth; it seemed, therefore, desirable to pull it from as near the top of the crown as possible. This was done by beginning at the neck and crossing the ligature to and fro, tieing a knot at each angle of the zigzag, as seen in Fig. 20 *c*.

"The mouth and plate being now both ready to be brought together the end of one of the ligatures on the lateral (Fig. 20 *f*) was slipped through the elastic ring *b*, also one of those on the canine *g* through the ring *a*.

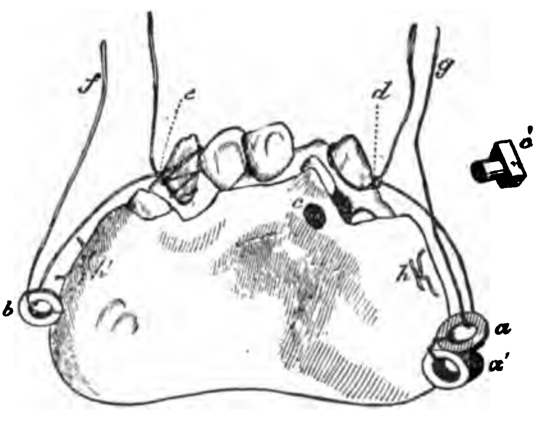

Fig. 20.—Balkwill's method.

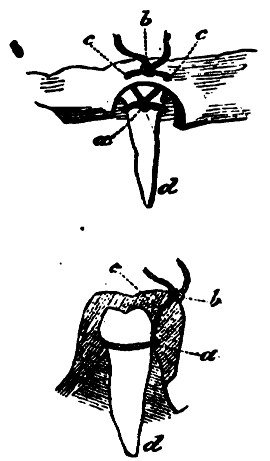

Fig. 21.—Method of attaching Fig. 20.

"The ligatures for tieing the plate on to the bicuspids were threaded in their respective holes as previously described, and the plate placed in the mouth and tied by them (Fig. 20 *h*).

"By drawing upon the ligature (Fig. 20 *f*) the elastic *b* was brought up to the knot *e*, and whilst held there by a blunt instrument tied. The same thing was now done to the canine on the other side by drawing upon the ligature *g* and tieing it at *d*. The distance between the knot *d* and the knot which tied the elastic *a* on to the plate was $1\frac{1}{16}$ inch, and the stretch of the elastic on the other side was the same.

"It being deemed advisable to try and bring the left lateral more out into the range of the teeth, it became a question for consideration whether it was better to draw it by an elastic or push it by compressed wood. The tooth being comparatively short, it was decided to draw it out by elastics, as compressed

wood acting on the inclined plane of the back of an incisor has a slight tendency to thrust it farther into its socket as well as outwards.

"The plate (Fig. 22) was therefore made, and fitted and tied in as the previous one. It carries a band of vulcanite, *a a,* in front of the incisor teeth without touching them; this was about half an inch deep and the tenth of an inch thick; it passed in front of the left incisor at a distance of a quarter of an inch. Through this band a hole was drilled at *b,* just opposite the tooth and rather above the line of the gum, so that the strain of ligatures passed through it to the lateral should be rather upwards as well as outwards. The outside edge of the hole at *b* was well countersunk, rounded, and polished, so as to give as little friction as possible to the ligatures; there *f f* and *e e* having been pre-

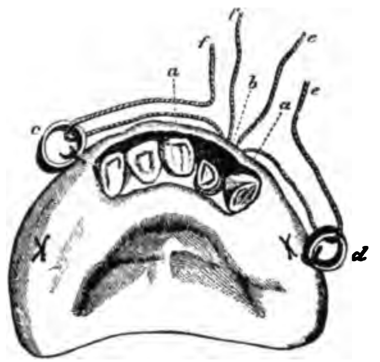

Fig. 22.—Another means by using a vulcanite plate.

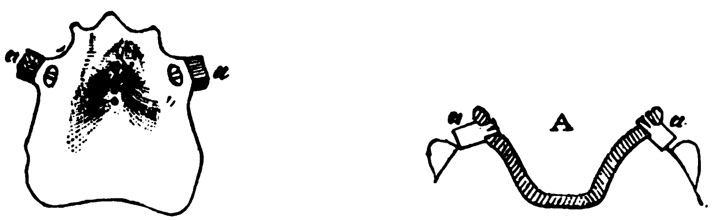

Fig. 23.—An appliance with wooden pegs drilled in.

viously tied to the lateral were brought through the hole *b,* passed through the elastics at *c* and *d,* which were then stretched up to *b* and tied."

Another appliance consisted of a plate with holes drilled in "in such a direction that the peg shall press rather hardly into the gum, as it is advantageous to press the teeth from as low down as possible; partly because the power of the peg is in proportion to the amount of wood acting, and perhaps partly because it sets up a little beneficial irritation. This must not be overdone: it is only meant that the wood should rather press on the gum than be just touching (see Fig. 23). A little wedge of wood driven into a small end of the peg after it is in the plate will hold it firmly, and prevent your being annoyed by its coming out and being lost on the carpet when fitting to the mouth with file or penknife (see Fig. 23 *a, a*). The pegs may be changed twice a week whilst the space is very narrow, as the amount of wood being small we must make use of every

little gain until a peg of substance is admissable, when visits of once a week will be preferable.

"When sufficient space to admit the canines is gained, the same plate will suffice for drawing them into it.

"A stout elastic ring, got by cutting off a quarter of an inch from the black rubber tubing sold by druggists for enemas, is tied by the middle to the center of the palatal portion of the plate (see Fig. 23 *b*). Tie ligatures to the canines, and pass one end from each of these through the holes previously occupied by the pegs, through the loop of elastic nearest to it and back again through the same holes. The elastic is then stretched up to the holes by drawing on these

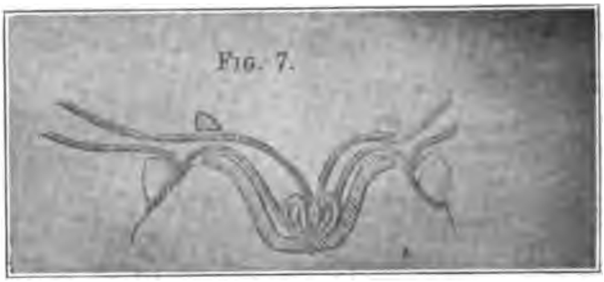

Fig. 24.—Method of bringing incisor teeth into line.

Fig. 25.—Another method of accomplishing the same purpose.

ends, and the two ends of the ligatures being tied keep it there, by its reaction to draw in the canines (see Fig. 24).

"When an incisor above or below is crowded outside the range of teeth, it can be brought in, and the adjacent teeth pressed aside to make way for it, very advantageously, by a straight piece of elastic interlacing them. A plate must be made which may cap the back teeth and come across the mouth behind the tooth to be operated upon, leaving room for its inward progress. Holes are drilled as near the proximal edge as is convenient, about half an inch on each side of the offender.

"Take an elastic ring, such as can be purchased at any stationer's, about a quarter of an inch in width, and as thick as a shilling. Cut a piece from this of such a length that when its ends are tied at the holes previously drilled it will lie

a little stretched between its attachment. The plate is now tied in the mouth to any convenient teeth, the elastic lying across the gap behind the prominent tooth. With a blunt instrument draw it through this gap, and slip the loop thus formed over its crown. Should there be any tendency to slip off it can be tied by a thread embracing crown and elastic diagonally.

"Fig. 25 shows a bird's-eye view of such an arrangement for the lower jaw: (*a*) central incisor; (*b*) strip of elastic rubber fastened to the frame at (*c.c.*)."

E. Balding, in the same journal, same year, page 531, *On the Treatment of Irregularities of Permanent Teeth,* wrote:

"In the course of my practice, treating cases of irregularities in the upper central and lateral teeth when they fall behind the lower ones, I have tried various plans.

"I have, instead of the compressed wood, used with better results large-headed swivel pins; but each of these methods seemed to me more or less defective. The success of the first depending too much on the voluntary efforts of the patient.

"In the second, the compressed wood required removing every day or every other day.

"In the third, the pins needed frequent readjusting as the teeth were moved forward to keep up the necessary pressure. All this in my judgment occupying too much valuable time, and entailing an unnecessary number of visits on the patient.

"In thinking over the subject it occurred to me if the principle of the inclined plane could be introduced into the upper instead of the lower plate, it would accomplish the object desired in less time and much more easily."

Winter Exodontia Club Number One

THE exodontists of Minneapolis and St. Paul had their first formal meeting at the Minneapolis Athletic Club, May 19, 1918. The guest of honor was Dr. George B. Winter, of St. Louis, the author of "Exodontia," and the originator of a new technic for the removal of impacted lower third molars. Dr. Winter demonstrated the efficiency of his system by removing a large number of impactions, at a clinic, the average time employed being less than one minute.

For recognition of his contributions to science, the Club honored him by naming this, the first organization of its kind, for him. The officers are: Harry B. Clark, President, and Carl J. Rice, Secretary.

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EDITORIALS

Education and Eugenics

AT the present time a great many articles are being written on the question of dental and medical education which have for their object the better education of the dental and medical man by increasing the preliminary requirements for college entrance and the lengthening of his professional course to a greater number of years. The purpose of this is to make him a better professional man and undoubtedly will accomplish it to a certain extent.

At the same time a great deal is being written on the question of a better education of the professional men another group of writers are producing articles on the question of improvement of the human race or upon the subject of eugenics. At first observation the subject of medical education and the question of eugenics may be close together or may be far apart. In fact, very

few individuals have given much consideration to the relation existing between higher education and eugenics. Those who may have been following the writings upon the question of bettering the human race have probably been surprised by the fact that college graduates, both male and female, do very little in regard to reproducing the human race as compared with individuals who are not so highly educated.

The number of children born to college men is very small compared to those born to individuals who are not college educated. The majority of women who are college graduates also make very "poor" mothers when judged by the number of children they rear. This would seem to indicate that higher education which should be an assistance to eugenics is really a detriment towards the reproduction of the human race. When we stop to consider the small size of the families as found among college men or the entire absence of children, we must admit that the individuals who seem to be the most suited to rear children from a standpoint of education, do not have them. Some writer a few years ago made the statement that the only individuals who knew how to rear children were the men and women who never married, which is almost true of college educated men and women.

We can equally say that it seems that the individuals best qualified to rear children are those educated along hygienic lines, but as a matter of statistics they have smaller families and produce fewer children than people who are not so well versed. Therefore, as a result of this the question of higher education and the question of eugenics for the improvement of the human race are working at variance with each other and as higher educational requirements are produced the number of children born to college graduates is going to continue to decrease instead of increase. In other words, from that class of people who seem to be the most suited to produce; so far as the improvement of the human race is concerned, we are going to have fewer and smaller families than we have had in times past. To state our subject more positive we may say that the increased medical and dental course is a factor which is contrary to the laws of eugenics and which is going to do more and more in the future to decrease the number of children born to medical and dental men. This is not only going to be true of medical and dental men, but is going to be equally true of men in other professions and training in which it requires a long period of education for the man to reach his goal. It would naturally seem that a medical man with his knowledge of medicine and hygiene would be the best qualified to rear a large family, but as a eugenical fact it is shown that they have smaller families.

This is not only true among medical and dental men but is true in other professions and lines of life which may be classed among the higher educated. In other words, the question of higher education and physiologic laws are at variance with each other and consequently the human family is going to suffer from the standpoint of eugenics just as educators continue to lengthen the time necessary for professional men to acquire an education and become self-supporting. Take for example the education of a dentist at the present time, in which it is necessary for the student to become a high school graduate before he can enter dental college. Then it is necessary for him to spend four years in dental school before he can graduate and then a certain number of years before he becomes self-supporting to the point where he feels he can rear a family.

By that time from a purely physiologic standpoint the individual has passed his most prolific years as regards the reproduction of the human race. It is a physiologic fact that the healthiest children are born from parents the father of which is between the age of 21 and 28. Those seem to be the years when the male of the human species is capable of reproducing the best offspring. Those years in the life of a medical or dental student are the years in which he is struggling to obtain his higher education or build up a practice so that he will be self-supporting. As a result of this every year that is added on to the education of a dental or medical student is simply added on at the expense of the physiologic life and reproduction, as studied from the standpoint of eugenics and related to the improvement of the human family.

We are willing to recognize the fact that the more highly educated the man or woman becomes the more they require in life, and the more they require of life's luxuries before they are willing to make the sacrifices to bring up a family. Along these lines we also note the more highly you educate an individual, the more you are going to force upon him a desire for those luxuries, and simply put the question of reproduction or improvement of the human race farther in the future until finally he gets so far along in the line of life that he is past his period of usefulness so far as eugenics is concerned. We therefore contend for the benefit of the human race there should be a physiologic side to the question of education, and the human family both men and women should not be so highly educated as to entirely obliterate the possibility of being useful in the production of the human race or in the improvement of the human race.

It is indeed a lamentable fact that the people who seem to be the most fitted to rear children as they should be reared are those who have the fewer children and the smaller families; and the only way this can be remedied is to recognize that there is a physiologic side to education and not make education such a specialty or so highly ideal as to eliminate the physiologic possibilities of educated men and women being useful from a eugenic standpoint. The only way in which this thing can be regulated is for educators to so arrange the education of professional men and women that they will be able to complete that education at a sufficiently early time in life so that they will still be able to fulfill the primary physiologic function for which they were placed upon this earth. When we consider the length of time that is necessary for dental students in times past to get an education and complete a three-year course and become self-supporting and be able to take care of a family, we recognize that the four-year course and higher education is simply going to place the thing farther in the distance.

The same is true of the medical student where the course has been lengthened year after year and now at the present time when a medical man obtains his education and spends the necessary time in a hospital and builds up a practice sufficiently large to take care of himself, he has become an undesirable subject from the standpoint of eugenics. As a result of this there is a question or relation between education and eugenics existing which should receive more attention from educators in the future than it has in times past.

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ORIGINAL ARTICLES

THE EVIL EFFECT OF ADENOIDS AND TONSILS UPON THE DENTAL ARCHES

BY OREN A. OLIVER, D.D.S., NASHVILLE, TENN.

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THE word "orthodontia" is not exactly descriptive of our science, in fact it only describes a part of what is really attempted, and covers only partly what is accomplished. We not only treat the malposed teeth, but also correct the deformities of the jaw, and the associated structures together with the complete, or partial correction of obstructed nasal cavity. The nasal and oral cavities, being so closely associated in normal conditions, what affects one, will also affect the other more or less. When we speak of the correction of malocclusion, we mean the correction of abnormal conditions associated with the teeth, which may be the teeth, arches, jaw, nasal cavity, or muscular, and atmospheric pressure.

During the past few years, a large number of articles dealing with malocclusion have called attention to the fact that mouth-breathing is a very important factor in the production of these deformities. The cause of mouth-breathing has not been given as much attention by the dental profession as it should have received, and therefore this paper will deal primarily with the direct results of adenoids and tonsils, and conditions associated with them. In speaking of adenoids and tonsils, we may state that they include a group of lymphoid tissues, located in the pharynx. This lymphoid tissue has received considerable attention from the medical profession in times past, and has been recognized as such a prolific source of infection that it has been called the "vicious circle."

The lymphoid tissue located in the pharynx may be termed a circle because certain masses are located in the different parts of the pharynx, con-

nected with lymph channels in such a manner as to form a complete chain of lymphoid tissue surrounding the nasal and oral pharynx. These masses of lymphoid tissue have been named tonsils by the anatomist, although the lay public when speaking of tonsils generally only include that mass of lymphoid tissue located in the oral pharynx, between the anterior and posterior pillars of the fossae.

The adenoids proper are a mass of lymphoid tissue located in the nasopharynx just posterior to and above the soft palate at a point corresponding to the base of the sphenoid bone. This mass of lymphoid tissue has also been called the pharyngeal tonsil, because of its location in the nasopharynx. It is composed principally of this mass of soft lymphoid tissue, and has a very small connective tissue covering, and consequently is the softest mass of lymphoid tissue found in the pharynx. It has been named adenoid tissue, because it so closely resembles a glandular structure, but it is not truly a glandular tissue. This lymphoid tissue is present in every child and only when it becomes sufficiently large to project forward does it come in contact with the soft palate, and thereby becomes a pathologic factor in the production of mouth-breathing.

If the lymphoid tissue, or adenoids located in the nasopharynx becomes sufficiently large to obstruct the nasal respiration, the individual immediately becomes a mouth-breather. As a result of the production of mouth-breathing the adenoid tissue becomes a potent factor in producing a series of deformities through lack of development, which is noticed in a large number of individuals who are chronic mouth-breathers. It must be remembered that the adenoid tissue located in the nasopharynx is the most prolific cause of mouth-breathing in children, and the large number of maldevelopments that follow. They also are produced by a series of changes, which are brought about by mouth-breathing regardless of the cause. In order for the nasal and oral cavities to develop as they should we must have normal conditions, known as the forces of occlusion, one of which is normal atmospheric pressure, and another normal muscular pressure. In the normal individual during normal respiration the lips are closed, and the air passes through the nasal cavities, and exerts force upon all the walls of the nose. The force exerted upon the walls in nasal-breathing causes a normal development of the nasal cavity, which includes a downward growth of the roof of the mouth, and thereby causes a proper development of the nasal septum.

During normal breathing the mouth is closed, and the tongue occupies the whole of the oral cavity with the exception of a small space between the central portion of the tongue, and the extreme posterior part of the roof of the mouth. The back portion of the tongue is in contact with the soft palate, therefore producing a vacuum between the base of the tongue, the soft palate, and the lips in front, which is for the purpose of holding the mandible in proper position. In normal breathers, the mandible is not closed by muscular effort, at least, it is not kept closed by muscular effort, but held in position by atmospheric pressure resulting from the vacuum produced between the palate and the tongue.

We will observe in normal breathers that the mylohyoid muscles to a certain extent do not drop directly from their origin at the mandible, but are in a more or less right angle arrangement due to the fact that atmospheric pressure holds the soft tissue under the tongue up against the tongue, and thereby gives a square appearance to the mandible. In mouth-breathing the mylohyoid muscle and the tissue under the tongue drops downward, resulting in a diagonal line being formed between the point of the chin and the hyoid bone.

In mouth-breathing, we lose the normal force of atmospheric pressure during respiration, and we lose the normal action of the tongue in these developments of the dental arches, and the restraining influence of the upper and lower lip on the anterior teeth, which result in a series of deformities developing which may be described as follows:

In mouth-breathers we find the upper dental arch does not develop laterally as it should, and consequently remains in a narrow condition.

In addition to the lack of development we also find there is a lack of downward growth from the roof of the mouth, which results in the roof of the mouth being too close to the roof of the nose.

As a result of this, the nasal septum does not have sufficient room to grow downward, and consequently in a large number of cases becomes deflected in the form of the letter *S* presenting one or two curvatures from above, downward.

The mouth being held open, there is no restraining influence exerted upon the upper anterior teeth, and consequently there is a tendency for them to protrude, and this protrusion is further assisted by the fact that the lower lip falls between the upper and lower teeth in such a manner as to assist in forcing the upper incisors forward.

As soon as the individual becomes a mouth-breather the mandible is held open, as a result of which the muscles of the mandible exert a downward pull upon the mandible, which retards the development of the body of the bone forward.

The lack of forward growth of the mandible very soon allows the distal relations to develop, which results in the lower arch being distal to the upper arch.

As a result of these abnormal forces of occlusion, the facial deformity and malocclusion tend to become worse as the individual grows older. In a large number of these individuals, who are mouth-breathers, we also find enlargement of the faucial tonsil, which is a mass of lymphoid tissue located between the anterior and posterior pillars of the fossa.

These are the so-called tonsils, which the public are familiar with. The faucial tonsils do not exert as deleterious an influence upon the dental arches, and do not directly produce the prolific cases of malocclusion, as do the hypertrophy of the nasal pharyngeal, tonsil, or the adenoid tissue, because of the fact that they themselves do not produce mouth-breathing. We find, however, that inflammation of the faucial tonsil in young children is very apt to

produce a different type of malocclusion, than that which is produced in the typical mouth-breathers.

Dr. Angle called attention to the fact several years ago that a large number of children suffering from the condition known as mesioclusion, were found to be suffering from an inflammation of the faucial tonsils. Inflammation of a faucial tonsil may be conducive to mesioclusion, by the fact that children who have inflammation of this mass of lymphoid tissue, may unconsciously protrude the mandible, and consequently relieve the pressure upon the inflamed organ. As a result of this voluntary protrusion of the mandible, it becomes possible for the teeth during process of eruption, to become locked mesial to the superior maxillæ teeth, and consequently a case of mesioclusion will develop.

We do not claim that all cases of mesioclusion are produced by enlarged or inflamed faucial tonsils, but it is probably a factor in the production of the majority of these conditions. It has also been found that in individuals who have a chronic inflammation of the faucial tonsil, a large number of them may also be sufferers of other constitutional conditions, one of which may be rickets. Science also proves that rickets is capable of producing bone deformity, and as a result of this change, the mandible is liable to assume such positions as is characteristic of mesioclusion cases. You can therefore readily see that if the child is rickety, and also suffers from enlarged faucial tonsils, the chance for the development of a bad case of mesioclusion is more likely than in the individual who is not suffering from these conditions.

The evil effects of the diseased tonsils upon the dental apparatus, as well as upon the development of the nasal cavity must be given consideration by everyone engaged in the practice of dentistry and medicine.

A SYSTEM OF ORTHODONTIC RECORDS*

By Carl O. Engstrom, D.D.S., Sacramento, Calif.

CONSIDERING the recent advent of orthodontia as a profession, its rapid growth, its great influence in the promotion of personal efficiency and its future prospects, a system of records adopted and used by all members will no doubt redound to the mutual advantage of all concerned as well as to the advancement of the science. Most professions have some standard outline for recording their work. Their use has been of great value in the compilation of statistical reports and many deductions and discoveries pertaining to scientific subjects have resulted from well arranged systems of tabulated facts. In research and in study of subjects like orthodontia demanding observation, comparison, and deduction, they are a most important adjunct. The need of a system of records was evidenced by the action of the American Orthodontia Society when they appointed in 1916, a committee to report at a later meeting on a system of records. Why no standard form for records has been adopted by the orthodontic profession may be due to the many personal ideas as to just what should constitute a practical system of records. Then again, but a few years ago, practically a sole dependence on the workings of some system of appliances necessitated only such records as models and photographs of patients before and after treatment. Since that time a better understanding of the laws of nature has so altered our former ideas that a system of records in detail is becoming an evident necessity and without some definite outline to follow they become but a great mass of scattered information of little practical value. Many of the questions regarding these laws may be answered by deductions from reports of a number of cases. Then again, with the facts now known regarding the laws of nature in orthodontia and the means used in treatment, and wherein every case is treated according to the conditions peculiar to itself, how much can one mind remember of what was done in but a month past on all, say fifty cases? What then of the scientific value to be gotten from the explanation of past treatment of any one case, wherein memory is the only means of verification? While veracity and achievement are not to be questioned, scientific results must be based on known recorded facts and there is no better means for satisfactory substantiation of results than records in detail made at the time of the execution of the work.

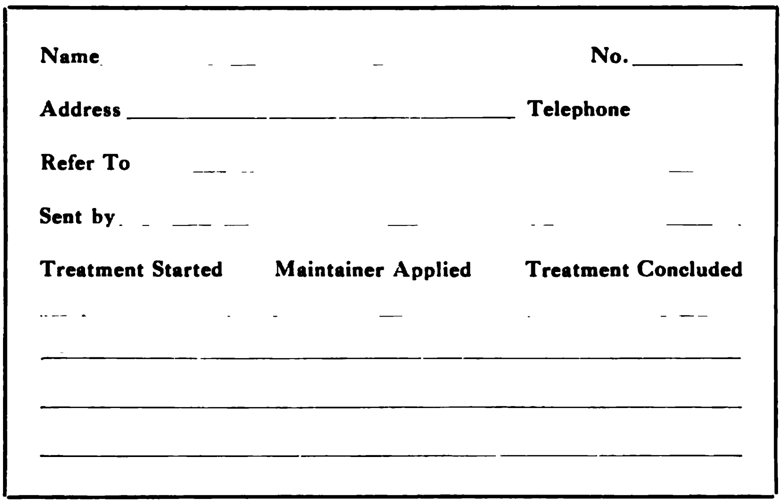
It has well been said orthodontia is enough to tax the greatest of minds. Records are the memory of facts that should not be a burden where more essential knowledge should be. In treatment it is ofttimes of advantage to refer to past treatment or to treatment of other cases and therein records present considerable worth. As a means of comprehensive description of previous treatment, a record in detail will save time and much correspondence in the transfer of a case by one orthodontist to another and thereby a correct appreciation of such treatment may be gained. A more correct appreciation of the study, work, time employed, and compensation may be gained by the use of records in detail. While this naturally necessitates some work, much time and

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., February 18, 19, 1918.

work may be saved otherwise in the treatment, and if not, the effort will at least be commensurate with the increased efficiency of the operator or with the assistance which may be given the promotion of the science.

In a systematic record it is desirable that it be efficient and this may be stated as the serving of a three-fold purpose; as an outline of facts of interest to the profession, facts of interest to the operator, and facts of interest to the patient. It is desirable that it be comprehensive in detail, simple in arrangement for perspicuity and practical in ease and quickness of handling and notation. It is desirable that it be of such arrangement that additional data may be easily added and yet not be voluminous. It is desirable that it be a means of readily depicting necessary data, and also, it may be stated, a means of recording such data and leaving to the option of the operator a more extensive exposition of facts.

The system of record cards to be presented are the result of years of study of some practical means of keeping records in detail. Some years ago the writer presented to this society, cards whereby a diagrammatic record might be kept. The present system includes this same means of diagrammatic presentation. A number of the leading orthodontists of this country have used and are using this card and the writer desires at this time to tender thanks to them for their hearty cooperation in suggesting changes and in their approval of the present form.


Name **No.**

Address **Telephone**

Refer To

Sent by

Treatment Started **Maintainer Applied** **Treatment Concluded**

Fig. 1.—Three-leaf folder, showing outside flap. The actual size of the folder, when folded as above, is eight inches wide by five inches high.

This system consists principally of a folder and two cards, one for the facts of the case as presented and the other for notation of treatment.

The folder is what is known as a three-leaf folder and is of such shape and size that it may be easily handled in examination and in transferring and will accommodate all notes, photographs, radiographs, etc. On the outside of the folder (Fig. 1) an outline is provided for such matter as may be of importance in the identification of the case and which may be of use for ready reference.

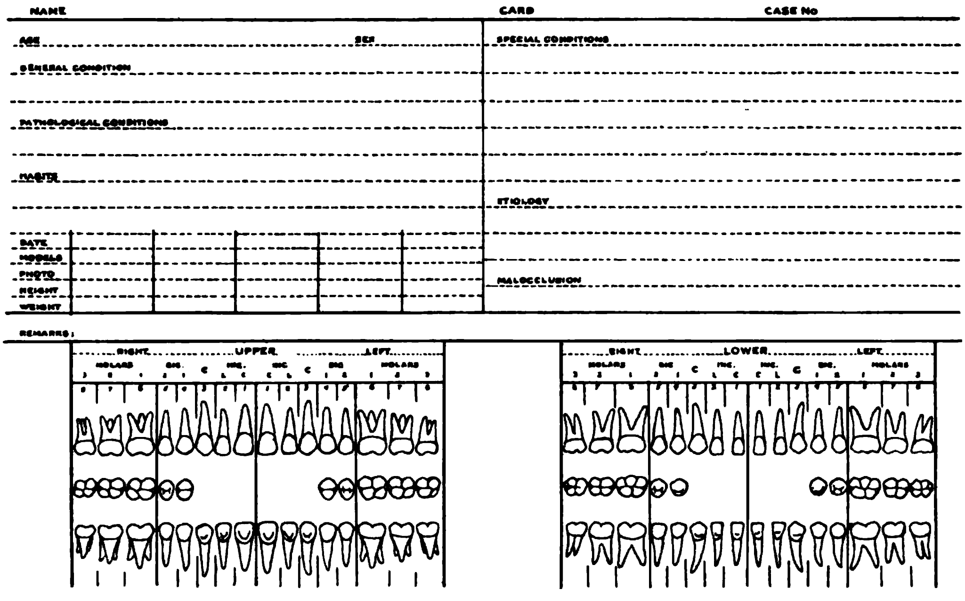


Fig. 2.—Face side of first card. The original from which this cut has been made is printed in two colors (red and black) and is eight by five inches in size.

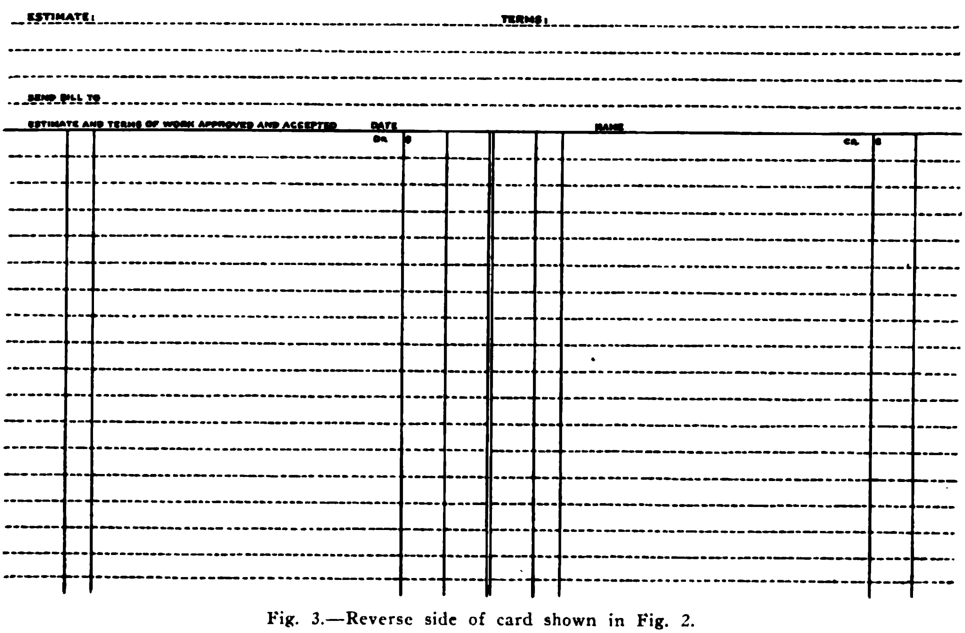
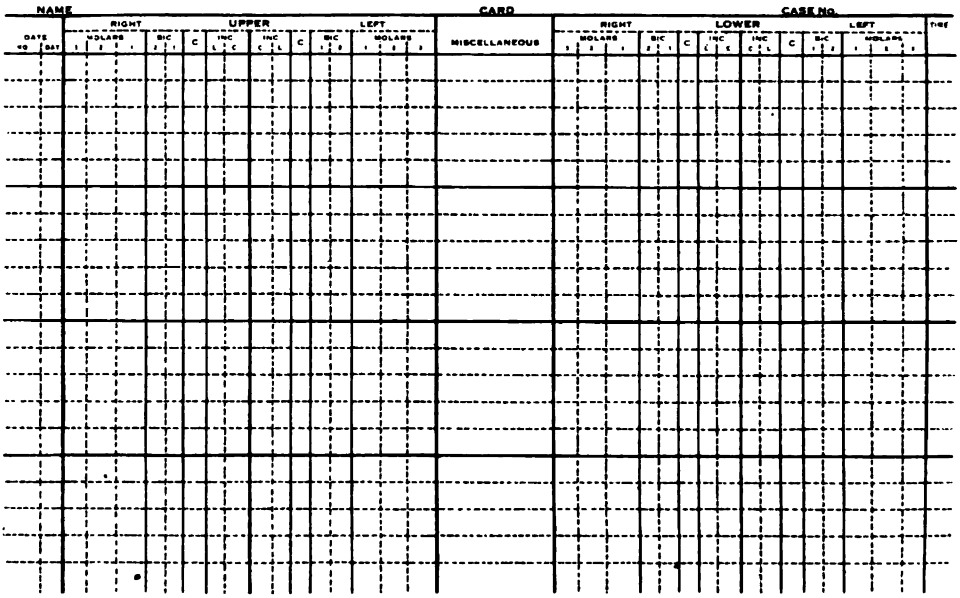


Fig. 3.—Reverse side of card shown in Fig. 2.


NAME CARD CASE NO.

UPPER: RIGHT — MOLARS, BIC, C, INC; INC, C, BIC, MOLARS — LEFT

DATE — NO. DAY

MISCELLANEOUS

LOWER: RIGHT — MOLARS, BIC, C, INC; INC, C, BIC, MOLARS — LEFT

TIME

Fig. 4.—Second card, which is the treatment record card.

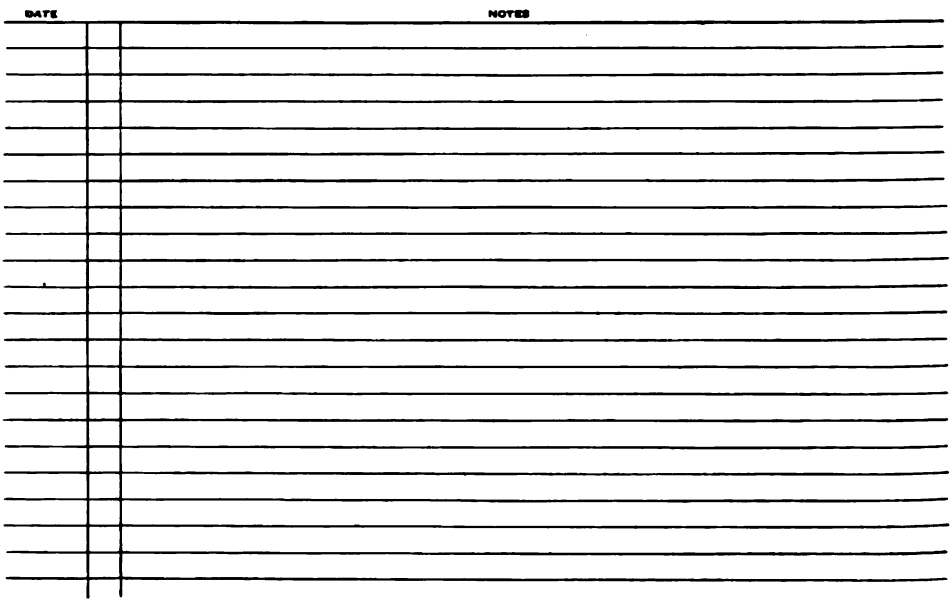

DATE NOTES

Fig. 5.—Reverse of treatment card shown in Fig. 4, with lines provided for notes.

For distinctiveness and neatness this is best typewritten. Here is written the name of the patient, the number of the case, the address of the patient, the telephone number, the name of the party to whom to refer, and the name of the person who sent the case. Of the last two notations if the former be a relative, such relation is stated in parenthesis, and if the latter be a dentist, physician, or former patient, that is likewise added. Below this is written the date of commencement of treatment, the date when maintainers are applied, and the date of conclusion of treatment. Under this are the lines for the entry of notes, such as those regarding time of appointment, conclusion of treatment, and result of treatment, etc.

On the face side of the first card (Fig. 2) spaces are provided for facts of the case as presented, these being only those of material value in treatment, and on the other side (Fig. 3) is provided an outline of the agreement, and the credit and the debits. As a means of record of questions and answers a list of same may be kept aside from the cards. That is a matter of desirability and knowledge of the operator and to be determined for himself. At the top of the first card, space is provided for the name of the patient, the contents of the folders, and the number of the case. Photographs, radiograms, may be designated by letters, and cards and other notes by numerals, so that all contents may be recorded. Below this are headings, such as age, sex, general conditions, pathological conditions, habits, special conditions, etiology, malocclusion, and as stated before only factors of value in treatment are herein recorded under these respective headings. Spaces are set apart for record of models, photographs, height, and weight at noted dates. Below this is a line for remarks.

The lower portion of the first card (Fig. 2) contains diagrams of the full dentures for the record of condition of teeth and mouth. The upper denture is on the left and the lower on the right of the center of the card. Additional notes may be entered regarding the examination and condition of the mouth and teeth in the spaces to the left and between the diagrams. It will be noted that the surfaces of the teeth are presented in the manner of examination. First, facial, then occlusal, then lingual. As entire teeth are presented, conditions of gums, crowns, and roots may be entered by drawings, signs, etc. Average measurements of teeth were used and reduced to fit the size of the card. At the lower border of this side of the card are vertical lines representing the position of contact points and also setting off the respective widths of the teeth. This will be alluded to in the description of the second card.

On the other side of the first card (Fig. 3) is a form to be filled out regarding the financial agreement and when signed by the responsible party makes it legal, without such appearance, as well as a valuable note to which to refer; hence, no misunderstanding can arise through forgetfulness. Below this is the form for debits and credits.

The second card is the treatment card proper (Fig. 4). At the top, the name of the patient, the number of the card (corresponding number being entered at the top of the first card), and the number of the case may be placed. On the face side of the second card are vertical lines corresponding with those at the lower border on the face side of the first card. Horizontal lines divide the card into twenty spaces and on each of these lines spaces are provided to left

of the card for entry of the date, and to the right spaces are provided for notation of time. This arrangement allows for drawings, showing the detail of appliances, bends, wires, position of spurs, etc. In the center space is provided for short notes and printed in this space at the top of the card is the word, "Miscellaneous." It may be observed that the vertical lines may be continued by additional cards. On the other side of the card (Fig. 5) lines are provided for notes.

A record of treatment may be made on this second card in either of these two ways, by drawings and abbreviations or by drawings and a verbal exposition. The first represents practically a full diagrammatic presentation. Time of appointment is entered to the left of the card, service rendered placed in its respective place or places and the time involved in treatment placed to the right of the card. Movement of teeth may be signified by symbols, as the spear, or by letter. When more than twenty appointments are required, another card for twenty more is added. Miscellaneous notes may be placed on the other side of the card. A list of all symbols in the use of this method should be made on the inside of the folder or on another card. By this method appliances and movements of each and all of the teeth may be seen at a glance. What was done at each appointment and time consumed is most clearly presented. By the other mentioned method of recording drawings are made of the appliances on the face of the card. All changes of appliances are recorded with their respective dates. The movements as intended are specified in words on the side of the card reserved for notes. This method may be as easily understood by others as by the operator.

In order to thoroughly appreciate a system of keeping records in detail, they should be used in practice and whatever of detail is recorded, it will be found to be of considerable value, but the more detail that is clearly recorded the more useful the system becomes, and this as stated before is a matter contingent on the personal knowledge of orthodontia in all its branches of study.

It will be noted that a great deal of information may be recorded by this system, that practically all space is used and yet an orderly outline is provided that is simple, comprehensive, easily understood and manipulated.

DISCUSSION

Dr. John M. McCoy.—There is no question but Dr. Engstrom has presented something really worth while, and his paper is deserving of our consideration. The value of the standardized record is obvious. When you consider that in our work the treatment at times extends over so great a period that our patients are referred back and forth, and as a rule a very meager record of the case goes with the patient, there is no question but this lack causes a great hindrance in the continuation of treatment necessary. To show how inconsistent most of us have been in the past, we will spend hours and hours of time in taking casts and trimming models beautifully, and then the record of the case is made in a few seconds or minutes, and we depend on our memory in most instances, and that is certainly not dependable in my case at least.

Years ago I devised a system of records myself, and while it has been of some help to me it is, I know, incomplete, and Dr. Engstrom's method is certainly very complete and will help us in standardizing our records. I congratulate Dr. Engstrom on his presentation of this subject.

Dr. Solley.—Mr. President and Gentlemen: Today we are moving along the lines for a standardized nomenclature. It seems to me, as Dr. McCoy has said, that a standard-

ized record data is just as important, especially when our patients go from one man to another. If we could send these records to the other man, how much easier it would be for him to carry on the work. I have used Dr. Engstrom's cards about three years. I like particularly the idea that whenever you band a tooth you mark it on your card, and no matter how many cards you have you can always see exactly what you have done. The cards are very easily kept in a small desk file, close at hand. The backs of these cards are extremely useful for recording all data in the way of letters you have sent parents, or special instructions you have given in oral hygiene. I think we are too lax in keeping records of various instructions we give our patients, and if any of us are unfortunate enough to be called in court, any specific written data on the back of your cards will stand you in good stead. It is the best evidence as to any instructions you may have given your patients.

Dr. Engstrom.—In response to Dr. Cavanagh's suggestion as to some method for recording erupting teeth in lieu of removing appliances and making casts, I believe it would be well to mark the deciduous teeth and permanent teeth in place when you start. As the case develops, and for instance a central incisor is removed, you make notation of the date, and when the permanent central incisor erupts you follow down the column and find the "extraction" and "eruption" at this date, etc.

LOCAL AND SYSTEMIC EFFECTS OF MALOCCLUSION*

By Varney A. Kelley, D.M.D., Seattle, Wash.

THE subject of this paper is one of far-reaching possibilities. The difficulties encountered in treating the subject lie in selecting the most important and interesting points, not in finding sufficient material to consider.

I do not want any one to think that I consider the points I attempt to bring out as new, for I well know they are not. All I can hope to do is to give a sort of a resume of the things you already know, hoping some of you will be able to derive some benefit therefrom.

Under the local effects of malocclusion the first thing to enter our minds is the personal appearance. How many of you are there who have not seen people who seem very attractive while their face is in repose and who, upon talking or smiling, are changed by the display of a very irregular set of teeth to an unattractive person, and the reverse is also often encountered that a very plain person, while in repose, will, upon the display of a regular set of teeth, become almost attractive to look at.

We all know that upon acquaintance, it is the real man or woman that counts and not the looks, but we must also admit that until we have had an opportunity to become acquainted, one's facial expression and personal appearance has much to do with the confidence we feel we can repose in them. Looking at the matter from this angle it is easy to see the effects that malocclusion has in influencing one's opportunities in life. In the business world today, where there is so much competition, there can be little dispute that a pleasing countenance is a big asset.

So much for the physical personal appearance; now, I want to touch for a minute on what I will, for the lack of a better classification, mention as the mental appearance, by which I refer to the intellectuality as expressed in

*Read before the King County Dental Society, Seattle, Wash., April 2, 1918.

the countenance. Occasionally, we see people with irregular teeth who have a very bright, intelligent countenance, but this is the exception that proves the rule, for I think it is almost invariably the case, that a person with malplaced teeth, especially with constricted arches, has a stupid and absent-minded look that is a serious handicap to them, especially in the earlier stages of their business career, and I am firmly convinced that their intellectuality is not what it normally should be. In my limited experience, it seems that nearly every case that has come under my care, where the arches were narrow shows not only to me but to the parents, upon expansion, a marked improvement in their ability to apply themselves to their studies and this improvement begins to manifest itself in an incredibly short time. In one particular instance a lady presented her niece for treatment, the little girl was a bright appearing person and yet when studying her closely showed a sort of absent-mindedness and after I had the appliances adjusted, I remarked to the aunt that in three or four months she would notice a difference in the girl's mental ability, and she smiled as much as to say "The same old stuff." In two and a half months she came to my office alone and said she had come to apologize to me for thinking me over enthusiastic in my work, that she had always considered Marion a very bright girl, but that morning she had been talking to her teacher who remarked on the late improvement in Marion's school work and the aunt said she had never seen her accomplish so much in her music as she had in the past two or three weeks. Now this is not an exceptional case but is only a fair sample and is a phase of the work that I feel should be considered very seriously in connection with this branch of our work. If a child can apply himself so much better to his work, it must needs follow that the efficiency of the adult must be increased in an even greater proportion.

Another result of malocclusion is the receding chin, we can all recall some one whom we know, whose personal appearance is greatly impaired by this misfortune and yet this is one of the irregularities which is entirely and easily remedied if taken at an early age.

To me it has always seemed difficult to differentiate between cases of malocclusion caused by obstruction of the normal breathing by adenoids and cases of adenoid growth caused by constricted arches but I think there are many cases of adenoids that would be greatly improved if not entirely cured by the expansion of the arches. I am strongly in hopes the day is not far distant when our brother practitioners will recognize the important part normal occlusion plays in the success of their operations and will be more inclined to advise their patients to consult their dentist in regard to the matter.

Under the systemic effects of malocclusion it is very difficult to say where to begin and where to leave off so closely interwoven is ill-health with an unsanitary mouth, caused by teeth in malocclusion, and so irregular that it is practically impossible to keep the teeth in anything approaching a sanitary condition.

In the regular practice of dentistry, our one aim is to prevent decay and to produce as perfect occlusion as possible, recognizing the fact that in proper

occlusion only lies the possibility to properly masticate the food which produces the energy that runs the human machine.

We all know that the proper adjustment of the carbureter is necessary to prepare the gas for running the gas engine and it is far more important to have the proper adjustment of the teeth to prepare the food for the human system, and we all know well the results on the digestive tract when the food is taken into it in a half masticated condition.

Under the heading of both local and systemic effects in my mind comes the extraction of teeth to make room in crowded arches.

Nature makes no mistakes in the shape and sizes of the teeth to have them harmonize with the rest of the face and anything that is inharmonious is caused by some obstruction to the natural development. In all cases when the teeth are put in their proper positions their planes will be found to give the ideal masticating service that nature intended they should and after nature has had time to build up the new tissue around the teeth in their new positions it will be found that the size and shape of the teeth will harmonize with the shape and size of the face.

Another very important feature which can be classed as an effect of malocclusion is the impossibility to keep an irregular denture in anything approaching a proper prophylactic condition, which in its turn is so often the cause of decay, and unless these teeth are taken care of we get the usual systemic poisoning, resulting in the general impairment of the entire system.

These effects that I have mentioned are only a few of the many that I could call to your attention and of which you are all cognizant, they are what seem to me the most direct and most common effects that we all see in our everyday life.

Alumni Society of the Dewey School of Orthodontia

AT the eighth annual meeting of the Alumni Society of the Dewey School of Orthodontia, held at the Edgewater Beach Hotel, Chicago, July 30 and 31, the following officers were elected for the ensuing year: President, Dr. O. A. Oliver, Nashville, Tenn.; Vice President, Dr. E. G. Weeks, Saginaw, Mich.; Secretary-Treasurer, Dr. George F. Burke, Detroit, Mich.

The place and time of the next meeting were left for the Executive Committee to decide.

A vote of thanks was extended to the retiring officers for the impartial and efficient manner in which they conducted the proceedings of the Society. A new Constitution and By-Laws were presented, amended, and adopted.

A PLEA FOR MORE ORTHODONTIA*

By W. E. Stoft, D.D.S., Omaha, Nebr.

IN writing on this subject of orthodontia, I feel I am dealing with a specialty that is in its infancy; I feel too that this child specialty is growing in spite of the apparent neglect of its real guardians, the dentists, and is being nourished to some extent at least, by foster parents and neighbors: I refer to the physicians and the laity.

We remember that Dr. Chas. Mayo said, "The next step in preventative medicine is up to the dentist." He also said, "Orthodontia is a coming specialty, not only in dentistry but in medicine," and again, "Society is going to wield the big stick and demand orthodontia treatment."

So by way of rejuvenation along this especially preventative branch of our profession, I wish to bring forth ideas both old and new.

Progressive dentists no longer say to young patients, "Oh! better wait to see if nature won't straighten out your teeth," nor do they harp on the thumb-sucking, pacifier-sucking, lip-biting habits that were once so exaggerated as etiologic factors. The theories of inheriting the teeth of one parent and the jaws of the other and also of inheriting one jaw of the one parent and the other jaw from the other side of the house are completely exploded.

The enlightened dentist of today, recognizes malocclusion early, even in the deciduous teeth and urges treatment at once.

He also knows that the great cause of malocclusion is the lack of the development of the alveolar process and approximating tissues; sensitive deciduous teeth being an important contributing factor to this lack of development.

Mouth-breathing is known to have some sort of evil effect upon occlusion and also upon the child generally and is one of the great causes of malocclusion. On these two prime etiological factors, I wish to enlarge.

In studying the development of the human dental arch, we must recognize the factors involved. Before the teeth erupt in the infant, the arch development is due to the sucking process, after the teeth erupt, they afford a means or handle if you please for the development of the arch. As the child approaches the time for the replacement of the temporary teeth by the permanent ones, there should have occurred arch development to the extent of causing a very noticeable separation of the front teeth. If this spacing has not occured, normal development has been prevented and malocclusion is present. This is readily grasped when we consider the difference in the mesio-distal diameter of the deciduous and permanent incisors. The eruption of the cuspid is so important a feature that I want to say, that as senseless would it be for a mason to remove a misplaced key to his arch of masonry and throw it away, as it is for a dentist to extract a malposed cuspid: a collapse of the human arch is sure to follow.

Mouth-breathing is another important factor in malocclusion. The teeth

*Read before the Tri-City Dental Society, Omaha, Neb., April, 1918.

under normal conditions are arranged as we all know, in a somewhat horseshoe shape, being influenced buccally, and labially by tongue pressure and retained by the lips and cheeks. If, as in mouth-breathing, the tongue does not afford the normal outward pressure and the cheeks are stretched somewhat, training the bicuspids and molars lingually, we have a "V" shaped arch and a protrusion of the front teeth in the upper arch; this last is due to the lack of normal lip-pressure, the lip being curled up short and functionless, as a result of the accompanying sniveling habit. Another feature of mouth-breathing and which is in a somewhat evolutionary stage, is the high vault or arch which indicates an underdevelopment of the sella turcica and therefore a crowded hypophysis or pituitary body. This pituitary body in short is the governor of internal secretions and encroachment of the walls of the sella turcica causes lowered vital resistance due to inferior functioning of the hypophysis. Therefore a suppression of the internal secretions or the excessive flow of these depending upon the nature of the crowding: Anterior lobe affects secretions, middle neck or infundibulum affects shock and nerve force, posterior lobe controls blood tone, etc.

Dr. Price told us at a state meeting a few years ago that he expanded an arch, brought down the hard palate and relieved pressure on the pituitary body and thus advanced a sixteen-year-old lad from a six-year-old sexually, to normal condition. Dr. W. E. Creath, of Ottumwa, Ia., told me of a seven-year-old girl who was menstruating at this age and was a fifteen-year-old, sexually, with hair around her vagina and under her arm, so reported by family physician. The menstruation stopped and was not repeated after four years' watching—all abnormality corrected in a very short time by no other treatment than the expanding of the arch and lowering of the palate. These cases while not enough to prove anything, give us an idea of future possibilities and a need for some research work. That there is some going on is supported by the following: Dr. Creath has for some time past been making blood tests of all his orthodontic cases and finds that in a large per cent of malocclusion cases there is an anemic condition and that the correction of the malocclusion always raises the red cell count, changes the polymorphonuclear cells and increases the number of eosinophilous; also increases the number of bone marrow cells, in most all cases bringing it up to normal. I am able to add a little testimony to these facts as I have had Dr. Gerald, bacteriologist of the Creighton Dental College make some tests and while I realize that this does not prove anything very conclusively, yet there is no doubt something very interesting about it. Out of twenty new patients who started to have their teeth regulated last year, I have figures to show that every case in which the teeth were brought into fairly good occlusion, there was a decided increase in the red cell count even in those cases which were about normal in the beginning. I noted this fact too, that the red cell count corresponded to the degree of masticating efficiency.

The following table compiled from blood examinations of orthodontic cases at the Creighton Dental College Infirmary, shows what took place in a school year of thirty-two weeks in these patients.

Orthodontic Cases—Red Cell Count—1916-17—1918-18

Patients	Sex	Age	Beginning	Corrected
1.	F.	16	3,392,000—	4,560,000
2.	F.	13	3,632,000—	4,600,000
3.	F.	12	3,680,000—	4,896,000
4.	F.	15	3,808,000—	4,784,000
5.	M.	12	3,888,000—	4,768,000
6.	F.	14	3,904,000—	4,512,000
7.	F.	13	4,064,000—	4,848,000
8.	M.	14	4,080,000—	5,040,000
9.	M.	11	4,144,000—	5,120,000
10.	M.	15	4,400,000—	4,624,000
11.	F.	11	4,608,000—	5,024,000
12.	M.	15	4,512,000—	5,040,000
13.	F.	13	4,720,000—	4,800,000
14.	F.	13	4,736,000—	5,072,000
			57,568,000—	67,688,000
Fourteen patients' average			4,112,000—	4,834,857
#15.	M.	12	4,080,000—	3,904,000
*16.	M.	16	3,520,000—	
*17.	M.	13	3,712,000—	
*18.	F.	14	3,824,000—	
*19.	M.	8	4,000,000—	
x20.	F.	14	4,800,000—	
			81,504,000	
Twenty patients' average			4,075,000—	

#Occlusion disturbed in the process of correcting—not so good as when started.
*These cases started but failed to finish.
xMalocclusion only slight, no final count.

Now since the next step in preventative medicine is to be made by the dentists, let us get off well together and prevent all the malocclusion we can and correct more of the unprevented and unpreventable cases which come under our notice.

A SUMMARY OF THE CAUSES OF MALOCCLUSION, WITH SPECIAL CONSIDERATION OF THOSE THAT COME UNDER FREQUENT OBSERVATION, AND WHICH SHOULD BE STUDIED AND GUARDED AGAINST*

By Wm. B. Power, D.D.S., Seattle, Wash.

ALMOST the first question asked by a parent when bringing a child to an orthodontist for consultation is: "Can you tell me what is the cause of this irregularity?"

The etiology of malocclusion is indeed so large a subject in itself, that it sometimes takes considerable time to reply to that question with any degree of correctness, or be at all sure of the answer to the particular case at hand.

Nearly everyone who has written at all on orthodontic subjects has compiled a list of the causes of malocclusion, until the reader almost wonders what will not cause it, rather than what will.

Dr. Angle, in his seventh edition, gives in the index as causes of malocclusion, arranged alphabetically and not in their order of importance:

Abnormal frenum labium,
Cleft palate,
Degeneracy,
Disuse of the teeth,
Enlarged tonsils,
Enlarged tongue,
Extraction,
Habits,
Heredity,
Imperfect fillings and crowns,
Nasal obstruction,
Nondevelopment of teeth,
Prolonged retention of deciduous teeth,
Supernumerary teeth, and
Tardy eruption of permanent teeth.

Dr. Dewey, while agreeing with his distinguished preceptor in naming these as the causes of malocclusion, has greatly enlarged on this list, and gives in addition, in the third edition of his standard textbook:

Abnormal development,
Abnormal lip,
Acquired,
Cell metabolism,
Chicken pox, an indirect cause,
Children's diseases, an indirect cause,
Congenital,
Diseases of the ductless glands, an indirect cause,
Environment,

*Read before the King County Dental Society, April 2, 1918.

Faulty development,
Family traits, an indirect cause,
Improper feeding of babies,
General or constitutional,
Harelip,
Improper diet,
Intermarriage of races,
Measles, an indirect cause,
Missing teeth,
Mixing of types,
Mouth-breathing,
Diseases of the pituitary bodies, an indirect cause,
Racial characteristics,
Rickets,
Scarlet fever, an indirect cause,
Sore teeth,
Syphilis, an indirect cause,
Diseases of thyroid gland, an indirect cause, and
Tuberculosis.

This formidable list of possible causes proves the breadth and scope of the subject we are discussing, and each and every cause given is worthy of consideration.

To show to what an extent Dr. Brady is impressed with nasal obstructions as a cause of malocclusion, let me give his outline of the causes:

Adenoids, 45 per cent.

Failure of normal enlargement of the dental arch from lack of pressure through mastication, 45 per cent.

Loss of teeth or parts of teeth through decay; failure in contour of fillings or crowns; extractions or accident; too long retention of the temporary teeth; abnormal frenum labium; unusually large tongue (thin alveolus); supernumerary teeth; delayed eruption and imparted teeth; transposed teeth; all 10 per cent.

Exception can be taken to this arbitrary percentage of each cause, as there is no way of arriving at a scientific ratio, but certainly the percentage caused by nasal obstructions must be large when an acknowledged authority gives it as 45.

It has been my experience in many cases, to hear from the parents of children, that they were advised that the malposition of the teeth was caused by finger or lip sucking, and in a great many cases they were further told that if left alone the condition might correct itself in time.

Just think of it. Think of the responsibility placed in the hands of the dentist for the future welfare and development of the individual, and then realize how that responsibility has been so lightly accepted by giving advice so unwarranted and unsound.

It is not in the scope of this paper to dwell at length upon bad advice as a cause of malocclusion, but it is clear that a serious responsibility rests on the dentist who fails to realize the importance of correct advice, on a point fraught with such possibilities of permanent injury.

When I think that a great many rhinologists examine their cases, advise treatment and do the work necessary in their own field of endeavor, and dismiss the patient, who in a great many of these adenoid and tonsil cases, has at the time, or is in fair way of getting, a malocclusion of the teeth, without calling attention to the fact; I say I am forced to think that such operators are either derelict in their duty, or ignorant of what the condition means.

Be sure and tell the parents of the children of the dangers of nasal obstructions, and advise them to consult a rhinologist.

We all realize the urgent need of such service for many children, but the rhinologist must also fully appreciate the need of orthodontic and dental service in many cases, if their ideal is to be realized.

Dr. Pullen says in Dr. C. N. Johnson's *Text-book of Operative Dentistry:* "One of the most serious abnormal conditions with which rhinologists and orthodontists have to deal, and one as intimately connected with the disturbance of normal function and structure in the field of one as in the other, is the partial or complete loss of normal respiratory function through the obstruction of the nasal, nasopharyngeal, and oropharyngeal air passages causing oral respiration, commonly known as mouth-breathing."

"That this condition, with all of its injurious results upon the development of the bones of the head and face, the disfiguring of the features, and the undermining of the general health, is becoming more prevalent, one hardly needs statistics to show, in view of the great numbers of those afflicted with this trouble in all walks of life."

We apparently seldom think when we see a case of enlarged tonsils in a child, that the condition is apt to cause one of the most unsightly forms of malocclusion that the orthodontist is called on to remedy.

These class three cases, mesioclusion or as they are sometimes called, lantern jaw or whopper jaw, where the mandible is greatly enlarged, with the chin well forward and the lower teeth in labial instead of lingual occlusion, are caused by mechanical stoppage of the air passage resulting from pathological growths.

This compels the sufferer to seek more respiratory room by holding the mandible forward, thus giving a freer air passage and greater comfort in breathing.

An important cause to which I wish to call your attention and for which you are in many cases responsible, is first and foremost, an honest consideration of the deciduous arch.

Proper advice to parents regarding the care and development of the deciduous teeth, proper foods, well masticated, are some of the greatest aids in the development of the "growth spaces," those spaces between the deciduous teeth which are so essential to the eruption and proper position of the permanent teeth.

Rickety children, and those who have suffered from malnutrition, have as a consequence, a faulty bone development which is often seen in malformed arches.

If you do not want to treat the deciduous teeth in your practice, in all fairness and justice, send the child to someone who will do it correctly, but there are few good reasons why most dentists should not accept this class of operative dentistry, and fewer excuses when they do so accept it, for failure to operate painstakingly and conscientiously.

The loss of deciduous teeth by extraction or decay with consequent loss of space is enormous. Failure to contour fillings and too long retention of the deciduous teeth are causes which come immediately under our observation. And please be careful when extracting a deciduous tooth that is fairly well rooted, not to place the beaks of the forceps over the bud of the permanent tooth which lies in immediate proximity to the root of the deciduous tooth, for I have seen some cases where this has been done, and the permanent tooth lost, with a mutilated arch as a result.

When any tooth is lost in either the deciduous or the permanent set, a certain amount of space is lost due to the tendency of the teeth to drift or move in the direction in which there is the least support, and sometimes the entire space is closed up.

Of course, here we have a shortening of the alveolar ridge, and in consequence, a form of malocclusion not easily remedied.

Another condition of importance is the tendency of teeth or roots too long retained, to deflect the crown of the erupting tooth into a malposition. The very inclined planes of the teeth, especially of the incisors, mechanically deflect these teeth, and once locked in a wrong position, they will grow and elongate themselves in that position, and so become permanently retained there.

Sometimes a very small amount of orthodontic treatment is necessary to correct the position of these erupting teeth, and then they will grow into their normal places.

An abnormally large frenum labium causes a very unsightly appearance in the incisor region, as the nature of this muscular tissue is to act as an elastic band or wedge, and thus spread the centrals apart, and give the appearance of a missing tooth in the most conspicuous portion of the dental arch.

This condition sometimes occurs in the lower arch, but I have not seen it there with the frequency and of the size that I have found it in the upper.

The condition can be remedied early in life by a very brief treatment, which should be done by all means, as it is too important to neglect.

Supernumerary teeth are also found as a cause of malocclusion, but it seems reasonable that when this condition exists as the direct cause of the irregularity, that the application of an ordinary amount of intelligence is fifty per cent of the treatment.

Such teeth should not be allowed to remain wedged in between the permanent teeth, for if this error is made they will in many cases surely cause a condition that is anything but sightly. Like broken down roots of the temporary teeth, they take up valuable space, and nature has not allowed room

for the normal number of teeth, plus extra teeth and roots in the normal arch.

Extraction will often remedy a condition that is bad and steadily growing worse, but in any event, do not pass these teeth by in fear, and say nothing to the patient or parent about the condition, for like temporary teeth that are retained till adult life, an x-ray is sometimes necessary to aid the dentist to a proper decision in such cases.

There is no one who thinks of ruthless extraction with greater horror than the orthodontist, but a courage born of knowledge that you are right, is sincerely to be looked for if cases such as these coming under our care are to receive the attention and correction that they deserve.

Eruptive fevers, measles, etc., and general constitutional disturbances as I said earlier in this paper, are given as causes of malocclusion by nearly all of the authorities.

That they cause this condition by a disturbed metabolism is assured, and our interest lies in knowing that this is so, and consequently doing everything we can to safeguard the health of the individual.

After all, that is our great professional mission, and there are few aims in life higher or more worthy.

Without doubt the dental profession realize this more thoroughly than in former years, and it is a satisfactory sign of the times, that their efforts for greater perfection are clearly recognized and appreciated by the public, and more especially by their brethren in medicine and surgery.

THE GROWTH AND DEVELOPMENT OF THE JAWS*

By F. G. Titus, D.D.S., Centralia, Wash.

THERE are certain phases in the growth and development of the body which are constant, and belong to the realm of heredity. They are teeth, hair, nails, eyes, fingers, toes, etc., and are typical of the species to which they belong. Their characteristics are impressed upon the centrosome of the original cell, the ovum, during a long series of generations. Any deviation from the typical is called a "variation" which may be only transitory or may be somewhat constant depending upon the degree to which it is impressed by succeeding transmissions. It is the purpose of this paper to deal with the development of the normal dental arch.

Beginning with the original cell, the fertilized ovum, there is a multiplication or proliferation of the cells which are at first homogenous with no definite arrangement. Gradually the cells arrange themselves into layers, and there is a differentation as to form or the establishment of types of cells which are to play their own special part in the formation of the various tissues of the body. Then we see this mass of cells developed from a single one, arranged into three layers, ectoderm, mesoderm, and entoderm.

From the ectoderm are derived the epithelial coverings of the outside of

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the body and of the oral and nasal cavities together with the enamel of the teeth, the hair, nails, crystalline lens, and nervous tissues, etc. From the mesoderm are derived the structural parts of the body, connective tissues, blood, lymph, muscle, bone, serum, membranes, etc.; and from the entoderm is derived the epithelium of the alimentary tract, and of the glands opening into it from the pharynx to the rectum and epithelium of the respiratory tract from larynx down, etc. This list is not complete but covers the tissues derived from the various layers in general, and illustrates the great specialization of the cells of the body, all derived from the one original ovum. As this specialization of the cells of the embryo continues the embryo becomes a foetus, which if normal and true to type will possess hereditary characteristics of its species.

Just what the forces or influences are which have produced this particular type of species is summed up in the term environment. That is to say environment is a term meant to designate the stimuli or forces which have influenced morphology of this type. This includes climate, food, food supply and pathological conditions, the mode of life, habits, etc., with which the individual has been forced to come in contact for a great space of time (a great many thousands of years).

We can see evidence of this specialization in the lower forms of the infusoria; for example, the ameba, the entire individual, consisting of but a single cell, with its cell wall and contents of protoplasm, nucleus, etc. This form of life responds to stimuli without any organs of special sense; no muscle, no nerves; no eyes, ears, etc. It absorbs foods through any part of the cell wall and expells its by-product through any part of the cell wall; it has motion and travels without any special organs of locomotion.

A very interesting illustration of specialization is seen in the Perimesium with its slipper-like form, its stoma for the reception of food and flagella for locomotion. In the Rotafer, we see a splendid example of specialization with its mouth or orifice for the reception of food, surrounded with flagella as organs of prehension, and set of little rockers or crushers through which the food particles must pass before it is digested and appropriated as food.

Thus, we see the idea of specialization carried out in greater detail the farther we progress along the scale of evolution to the higher types. In the early stages of embryonic development there appears in the head end of the embryo a series of branchial arches, five in number with four clefts, one between each arch. The first arch later becomes the lower jaw and the region just in front of the first branchial arch is occupied by the oral fossa; on each side of the oral fossa there arises the maxillary process, an outgrowth from the base of the mandibular, or first arch. These two maxillary buds or arches approach each other toward the median line but they do not meet; they join the nasal processes which are an outgrowth from the anterior border of the oral fossa, one on either side of the median. Later the maxillary processes and the nasal processes form the superior or upper jaw with the ends of the nasal processes intervening.

About the sixth week of embryonic life there is a proliferation of the epithelial cells lying upon the arches which later form the upper and lower

jaws. This proliferation occurs as a thickening or ridge of epithelium which gradually sinks into the mesoblastic tissue beneath, and becomes embedded therein. There is next a process of segmentation of this embedded epithelial ridge now called a dental shelf or ledge.

Now there is a process of pushing in, of the mesoblastic or connective tissue lying beneath the segment of epithelium which in turn takes on a cupped appearance. This epithelium cap becomes the enamel organ and the mesoblastic tissue within this cap, becomes the pulp and dentine of the deciduous tooth. During this process there is a little budding outgrowth from the first epithelial cap which forms the enamel organ of the permanent tooth. Now the arch which forms the lower jaw is supported by a cartilagenous structure which plays no part in the development of the bone, and later disappears.

Bone as it is found in the human body is of two varieties: the intracartilagenous and the intramembranous. But bone is bone wherever it may be found and is formed by a process of calcification in fibroembryonic tissue deposited by the osteoblast. In the intracartilagenous bone there is first a calcification of the cartilage preceded by the arrangement of the cartilage cells in definite rows. This calcified cartilage is not bone and is later removed as the true bone is developed. The bone in both jaws is of an intramembranous character.

In intramembranous bone there is a deposit of calcareous substances by the osteoblasts in a membrane of fibroembryonic tissue. The osteoblast is found in great numbers in the deeper and more vascular layers of the fibroembryonic membranes, whether it be the membrane covering, the intracartilagenous bone or the fibrous tissues in which the intramembranous bone is formed. The process is the same.

The jaw bones are developed from the fibroembryonic tissue from the mesoblast. It is built up about the developing tooth by the osteoblasts (bone-forming) which appear at this time. Upon examination of this bone it is seen to be developing by the Haversian system. The study of the Haversian system is of the most vital interest to the orthodontist and the dentist undertaking orthodontic procedure, as it is due to the functioning of the osteoblast and the osteoclast in building up and tearing down the Haversian systems in bone, that tooth movement is accomplished.

The calcification of connective tissue produced by these osteoblasts occurs about the blood vessels, arteries, veins, etc.

This Haversian System is ever changing in structure due to the activity of the osteoblastic (bone-developing) cells and the osteoclastic, cells whose function is to tear down bone structure. The process of metabolism and catabolism is constantly in progress in bone, as it is in the soft tissue, so there is a constant tearing down and elimination of bone tissue, as well as a constant bone building in progress at all times throughout the duration of life. This process is accomplished by the extension of branches of blood vessels into the bone, about which is built the new system of concentric rings with their lacuni

and canaliculi accompanied by the tearing down of the existing Haversian systems. Thus the bone secures its nutriment and the process of growth and generation and regeneration continues. As this calcareous formation occurs the osteoblasts are caught and remain as bone corpuscles, occupying the spaces called lacuni with their tiny processes extending into the little canaliculi; thus communicating with the neighboring ones.

The appearance of the Haversian system is that of concentric rings, of lamelli of bone arranged about a central channel containing as stated, blood vessels, etc.; filling in the spaces between the Haversian system is a formation of bone called interstitial bone which is the remains of old Haversian systems undergoing the process of being removed in the formation of new Haversian systems.

All bony tissue is either compact or cancellated. The compact bone being dense like ivory, and cancellated, is spongy with interstices. The other layer of all bone is compact and the inner part is cancellated, except the shaft of the long bones, which is entirely made up of compact bone, the center of which is hollow and filled with marrow; as are also the medullary spaces found in the cancellous bone.

I have endeavored to show that all growth and development of bone (including the jaws) is dependent upon individual cell activity and that cell activity is dependent upon environment—among which food, functional activity, and habit, are predominating influences.

In all our work covered by the field of dentistry it seems to me we are but dealing with symptoms, and that the fundamental causes must be corrected before we can hope to correct these conditions, decay, pyorrhea, malocclusions, etc.

The teeth in the process of development and eruption present an appearance of having been thrown into the jaws and one wonders that they ever assume a symmetrical and regular arrangement. As the development and eruption of the teeth occurs there is a corresponding growth and development of the surrounding tissues. There should be sufficient growth of the jaws to accommodate the teeth in proper approximation as they erupt and as the time approaches for the exfoliation of the deciduous teeth and the eruption of the permanent teeth there must be a spacing in the region of the incisors to accommodate the larger, permanent teeth. If this does not occur, we find them erupting in positions out of proper alignment of the arch.

In order to promote this, there are two conditions that are of paramount importance. They are functional activity and diet. Diet heads the list. It is not my purpose to go into the subject of diet, rations and foodstuffs in this paper but it seems plain that something is wrong with our environment here in America, for, American's digestive apparatus is notoriously out of kilter. Consider the prevalence of caries, pyorrhea, and malocclusion, ulcer of the stomach, appendicitis and other derangements of the alimentary tract. Contrast the diets and bad food habits of the Americans and Anglo-Saxon peoples with that of any of the more primitive peoples and the peasantry of continental Europe where diet is coarse and frugal requiring greater functional activity

and so-called Fletcherization, which is seen to induce a normal and proper cell activity in the growth and development of the organs involved.

Tooth movement is accomplished by the transposition of the tooth in the osseous process of the jaws. That is, the pressure exerted upon the tooth being moved stimulates the activity of the osteoclasts which change the bone in the region of the tooth and as the tooth is moved the osteoblasts build up new bone to support the tooth.

This movement must not exceed what might be called physiologic limits, and there should be no soreness. Too rapid movement would excite an inflammatory condition and thus retard metabolism; also bear in mind that after tooth movement is accomplished the tooth must be maintained in position until new Haversian systems of bone are built up about the roots.

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HISTORY OF ORTHODONTIA

(*Continued from page* 387.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY

E. MAGITOT, (1833-1897). We must look to France during the early and part of the last half of the eighteenth century for our information pertaining to dentistry. In that country, more than all the others, our science made its greatest stride and among her people we find some of our most renowned men of that period. Undoubtedly the foremost of the French dentists was E. Magitot, member of the French Academy of Science, and other prominent societies. An indefatigable worker, credited with some forty odd treatises on various dental topics, published in nearly all of the scientific journals, such as the *Journal d' Anthropologie, Archives De Tocologie, Archives Generales De Medicine, Journal De L'Anat. Et. De La Physiol, Gazette Hebdomadaire,* etc.

Fig. 1.—E. Magitot (1833-1897).

Anomalies of the dental system are numerous and varied and are the most important to be understood, yet up to the time of the services rendered science by the production of Magitot's work, all facts relating to this subject had to be looked for among documents scattered in every direction, there being no connection by which the literature of the subject could be traced. To Magitot the greatest credit is to be accorded, he seeing the importance of gathering this knowledge together, and combining all of the odds and ends, and what is of in-

finitely greater importance, he so arranged and classified these anomalies as to afford the practitioner at large an interpretation of them.

In 1877, twenty years after his first publication, Magitot published his great work entitled, *Traite des Anomalies du Systeme Dentaire Chez L' Homme et Les Mammiferes.* (*Treatise Upon Anomalies of the Dental System in Man and Animals.*) This volume of 305 pages and twenty plates is the most elaborate and scholarly essay upon the subject that up to that time appeared. It is an exhaustive study of the whole subject of dental variations and malformations. The author does not confine himself to his own observations, but embraces the results of the labor of others. The work is divided into nine chapters and a general introductory essay. His method is essentially the same as that employed by classical French writers, such as Isidore Geoffroy, Saint Hilaire, M. Davaine and others.

As was established by Saint Hilaire, the founder of Teratology, all troubles arising in the organization have origin in embryonic defects; it is there that the seat of disease is to be sought. The study of an anomaly existing in a given organ commences with the embryonic peculiarity. Magitot says, "With this understanding one has no difficulty in recognizing the cause for the little that is known concerning the peculiarities in the dental system."

Dental histogeny is a direction of science that has revealed its mysteries to but few. To even appreciate the labor expended in the discoveries made by Kölliker and Waldeyer in Germany and by Chas. Robin, Legros and Magitot in France cost in itself great zeal and research. What Goeffroy, Saint Hilaire has done for general teratology, Magitot has done for the monstrosities of the general system.

Magitot calls all dental anomalies deviation from the specific type. In the comparison he made between embryogeny and anatomy lies the appreciation of the phenomena associated with the diverse trouble of abnormal development, of suspension, of complete detention and of hypertrophy.

In studying morphology, Magitot found himself led to look on the dental display in the animal series as being derived from a single primordial origin. This primitive type, or dental unity, the agent principle of the second aspect, is found in a simple form in the very lowest of vertebrata. Fishes are found provided with teeth in great numbers: all more or less conoidal in shape. This is on the common principle that nature, always faithful to unity, modifies only according to requirements. In the more highly developed organisms of man the cusps of molars are recognized as modifications only of that which is the primal type. It is not, however, the case, that modifications which present in the ascending scale follow always rigorously in a zoological order. One is, however, able to say that, from a general method, the primitive type is forsaken according as the teeth diminish in number; the less the number the more complex being the form. The studies of M. Magitot are directed generally to that view of the subject which considers it from the standpoint of principles; his anomalies follow in the series of mammifera. He shows us the essential relative character. He makes us see by example that what is normality in one species is an abnormality in another; that many of the anomalies constitute in truth phenomena of return to one of the coherent halting-places, expressive of the morphologic changes of

the dental types. Pursuing farther, in man, these philosophic studies, the author is drawn to establish certain deviations seen in the dental system representative of the human species as unquestionable anomalies that take an ethnological character.

But the point, certainly the most original with M. Magitot, is that which has for its subject the "teratogeny" proper of dental anomalies, and which are divided by him, following the anatomical method into nine classes:

1. Anomalies of form.
2. " " volume.
3. " " number.
4. " " setting.
5. " " direction.
6. " " eruption.
7. " " nutrition.
8. " " structure.
9. " " arrangement.

The first in rank of the causes and laws which preside at the production of the greatest number of the dental anomalies is hereditary influences. The hereditary transmission alluded to by M. Magitot exists in that sexual affinity which may continue through generations, or which, by relation with new sexual influences may suddenly disappear; and which, assuredly in time, will disappear by reason of that natural law which of itself tends to the correction of irregularities.

As illustrative of M. Magitot's manner of dealing with his subjects, we direct attention to a few of his conclusions. "Number," he suggests, "lies in secondary buds. The irregular development of a bud explains the anomaly by numerical augmentation; absence of a bud explains absence of a tooth." Deviations in setting "Magitot" attributes to simple displacement of a tooth on the jaw, or in the neighborhood of the unrolling epithelial migration of the membrane forming its cyst. The great difference in jaws leads Magitot to discuss as a prominent feature in teratogeny certain deviations in the epithelial structure, which deviations allow of the development of a tooth after that same manner in which neoplasms come into existence, namely, by the migration of tissues from neighboring parts.

Apropos of the anomalies of structure, M. Magitot advances a very interesting question, namely, that the corrosive markings of permanent teeth, congenital alterations in shape, furrows, indentations, etc., often considered, most wrongfully, as a pathognomonic sign of predisposition to certain diseases, the hereditary syphilis, for example, are to be esteemed as indelible and permanent traces of invasions of infantile affections, especially convulsions. If this inference, based on a certain number of facts, but still contested, is found verified, the hypothesis put forth by Broca, that the prehistoric trepanations of children affected with convulsions was for the purpose of permitting the escape through the opening in the skull of a malicious spirit, may be accepted as the true one.

Magitot describes, in treating this subject, three methods of applications according to three phases, as follows:

1. The anomalies embryonic in origin, which include the deviation of position and number.

2. The anomalies of nutrition. Those forms, represented by the form, by volume and by structure (intrafollicular with odontomis and cysts).

3. Anomalies of development, eruption, direction and arrangement.

A synopsis of Magitot's classification of the anomalies of the dental system of man is as follows; each of the chapters is devoted to a special topic:

"1. To anomalies of form. These comprise the modifications in the form of the tooth, and either embrace the entire tooth-structure or are confined to the crown or the root.

"2. Anomalies of volume. These are of two orders: augmentation of the normal volume, or *géantisme;* diminution, or *nanisme.*

"3. Anomalies of number. These present three varieties: congenital absence, numerical diminution, and augmentation.

"4. Anomalies of position. These are divided into three groups: simple transposition, heterotopy by migration, and heterotopy by genesis (embryonic).

"5 Anomalies of direction, comprising four classes: retroversion, anteversion, lateral inclination, and axial rotation. The practical interest which is associated with these anomalies relates to the fact that the great majority of them are curable.

"6. Anomalies of eruption. These include the accidental disturbances in the order of eruption, retarded eruption, precocious loss, retarded loss.

"7. Anomalies of nutrition. These comprise all the functional disturbances attacking the nutrition of the tooth during its formative stage. They may include the entire organ, or be confined to one or more of its tissues.

"8. The anomalies of structure. In this group are included all alterations of an anatomical description situated in the different dental tissues; they are either general or limited, according to the nature of their producing cause, and determined by the time and duration of their appearance.

"9. Anomalies of arrangement. This last division includes a certain number of deviations from the normal standard, comprising amalgamation by anomalous division and a variety of troubles incident to deformation of the jaws."

The following table explains in greater detail his subdivision of this classification.

The author assumes that the typical form of the tooth is conoidal. After reverting to the characteristic features of teeth in fishes, he passes in succession to the different classes of animals, making general remarks upon the number of teeth in animals, notably those of the quadrumana. In speaking of the diastema, he remarks that this peculiarity does not imply necessarily the suppression of the canine, since it is found in the greater number of mammals; and that in the upper jaw it is situated between the canines and incisors, and in the lower jaw between the molars and the canines.

Under the head of the anomalies of the dental system, as considered in the human race, he treats of two different phases of the subject:

1. The relations existing between the teeth of primitive and recent man.

2. The variations occurring within the teeth of modern man alone. It has been reported that in the teeth of some fossil men a fifth tubercle has been found

TABLEAU SYNOPTIQUE DES ANOMALIES DU SYSTEME DENTAIRE CHEZ LES MAMMIFÈRES

- 1° Anomalies de forme
  - Anomalies totales.
  - Anomalies coronaires.
  - Anomalies radiculaires.
- 2° Anomalies de volume
  - Diminution ou nanisme
    - total.
    - partiel.
  - Augmentation ou géantisme
    - total.
    - partiel.
- 3° Anomalies de nombre
  - Absence congénitale.
  - Diminution numérique.
  - Augmentation numérique.
- 4° Anomalies de siége. Hétérotopie
  - Transposition.
  - Hétérotopie par
    - migration folliculaire.
    - introrsion blastodermique.
    - hétéroplastie.
- 5° Anomalies de direction
  - absolues ou totales
    - Prognathisme accidentel.
    - Opisthognatisme accidentel.
  - relatives
    - Antéversion.
    - Rétroversion.
    - Inclinaison latérale.
    - Rotation sur l'axe.
- 6° Anomalies de l'éruption
  - Eruption précoce.
  - Eruption tardive.
  - Chute précoce.
  - Chute tardive.
- 7° Anomalies de nutrition
  - Atrophie.
  - Hypertrophie ou hypergenèse. *Odontomes.*
    - bulbaires
      - embryoplastiques.
      - fibreux
        - avec ou sans grains phosphatiques.
        - avec ou sans grains dentinaires.
    - odontoplastiques.
      - cémentaires.
      - dentinaires
        - circonscrits.
        - diffus.
      - adamantins
        - Tumeurs hétérotopiques de l'émail.
    - radiculaires
      - cémentaires.
      - dentinaires.
  - Transformation kystique. Kystes folliculaires
    - prédentinaires.
    - odontoplastiques.
    - coronaires.
- 8° Anomalies de structure
  - totales
    - Défectuosités de la totalité de l'organe
      - accidentelles.
      - diathésiques.
    - Erosion.
    - Colorations anomales des dents.
  - partielles
    - Sillons et défectuosités de l'émail.
    - Vices de structure de l'ivoire.
    - Vices de structure du cément.
- 9° Anomalies de disposition.
  - Anomalies par continuité, réunions anomales.
  - — par disjonction, divisions anomales.
  - — par asymétrie des arcades dentaires
    - Atrésie de l'arcade dentaire.
    - Augmentation des diamètres de l'arcade.
  - Rapports anormaux des arcades dentaires.

upon the upper molars, as well as a fifth root to the inferior wisdom; the root of the inferior canine bifid, while the diastema is present.

M. Broca has observed the difference in the type of the Egyptian people with respect to the shape of the nose. It is found modified in form after the first Ethiopian invasion; but nothing beyond this analogy would seem to imply that any dental variations followed. The author quotes freely from Mr. Mummery as well as from Trousseau with respect to the dental variations in ancient skulls, which go to prove that dental anomaly was as frequent formerly as at the present time.

An interesting section is devoted to the relations existing between dental anomaly and active morbid processes; thus their serving as the exciting causes of cysts, ostitis, fistula, etc. Nor is the subject of anomalies as they occur within dermoid cysts neglected; and that strange phase of development by which teeth and hair are found well developed in localities where no such organs normally appear is thoroughly considered.

Under the head of anomalies of volume are discussed the malformations due to disease, notably those presumably excited by constitutional disease.

Elaborate tables of dental formula are presented, indicating not only the changes in the permanent dentition, but also those of the deciduous, and giving likewise a detailed account of the number of the teeth in mammals.

The plates are handsome lithographs, each containing from one to twenty-seven figures, accompanied with a very full table of description and explanation, and not infrequently figuring apparatus designed to correct malplaced teeth.

The large number of 274 figures in all, illustrate this elaborate study.

In 2000 cases of dental anomalies Magitot examined, he recorded as follows:

Anomaly of	form	92.
" "	size	120.
" "	position	193.
" "	eruption	154.
" "	arrangement	244.
" "	nutrition	208.
" "	structure	168.
" "	position	381.
" "	number	440.
		2000.

Nos. 5 and 9 from Plate XI of Magitot's work (Fig. 2) illustrate the devices mentioned by him and are similar to those used by Drs. Richardson and Redman and others. They were used to regulate the upper teeth by means of wooden pegs set in holes throughout the plate. The pegs bear upon the teeth so that they will tend to move in the direction desired. The appliance may be of vulcanite plate as shown in the illustration or skeleton crib form as in Plate XII (Fig. 3, Nos. 4 and 5) taken from Magitot's work, also Fig. 4.

A. H. Thompson. This review of orthodontic literature would hardly be complete if we failed to take into consideration the writing of Thompson. Although these were not purely of an orthodontic nature, Thompson was undoubtedly the foremost dentist in this country who wrote on comparative dental

anatomy. His contribution on this subject appeared in almost all of the dental journals and extended over a period of some thirty odd years. He created an interest in this subject and lived to see it incorporated into our school curriculum. We, as orthodontists, have found it to be the basis of our studies, but only a few have clearly seen the importance of further and deeper investigation

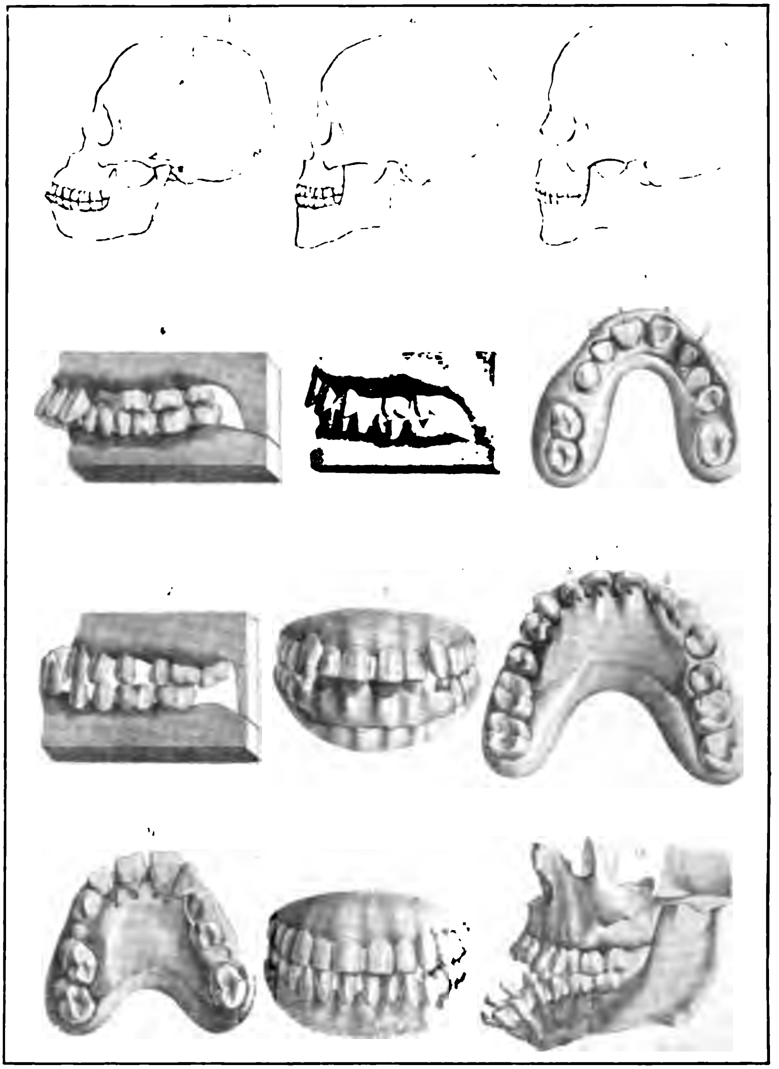

Fig. 2.—Appliances as used by Magitot to correct irregularities of the teeth (Nos. 5, 9, and 11). Vulcanite plate.

along this line of thought. Among a few of his papers we find the following, Canines in Expression, *Cosmos,* 1873; On the Ultimate Suppression of the Teeth in Man, *Cosmos,* 1875; Facial Expression, *Cosmos,* 1889; Origin and Evolution of the Face, *Cosmos,* 1890; The Architecture of the Upper First Molar, *Dental Review,* 1891; The Evolution of the Complex Molar from the Simple Cone,

National Dental Association, 1909; A Study of Comparative Occlusion and Its Bearing Upon Orthodontia, *Cosmos,* 1902.

Under The Dynamics of Dental Occlusion and the Structural Expenditure of Their Maintenance, *Dental Cosmos,* 1876, page 174, he states:

"The force with which the lower mandible is occluded against the superior maxillaries is, in the average mammiferous animal probably without parallel in

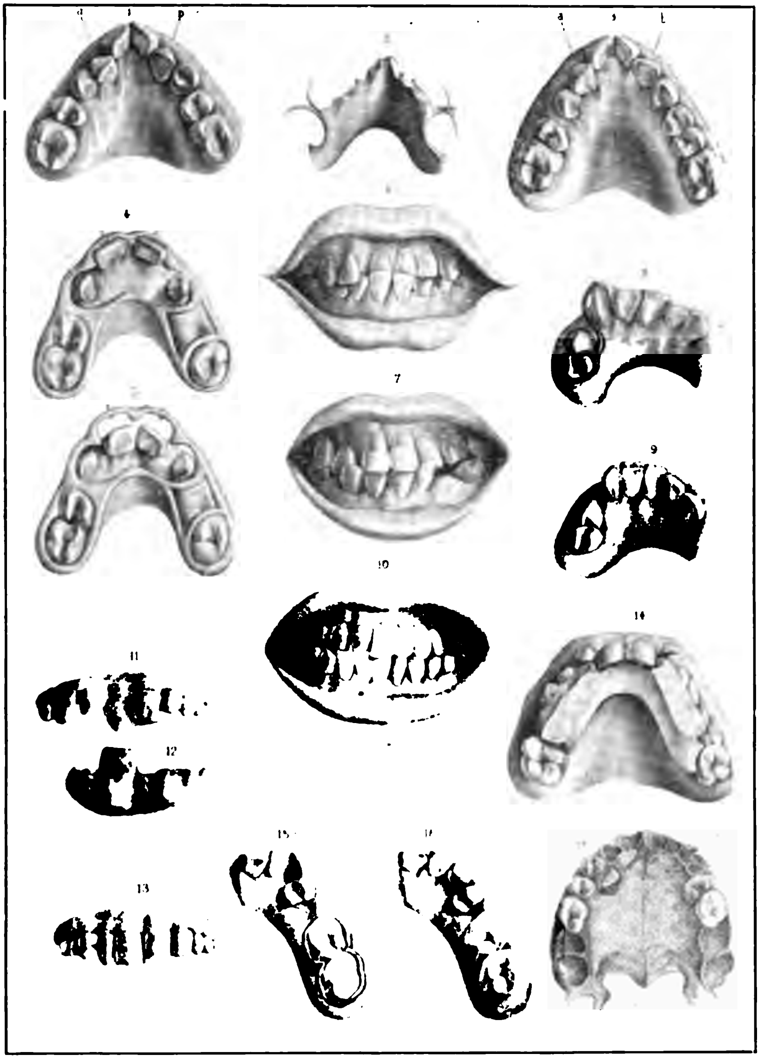

Fig. 3.—Skeleton cribs as devised by Magitot (Nos. 4 and 5). Vulcanite plate (No. 2).

any department of animal mechanics. The principles of construction and motion of the specialized parts devoted to mastication, and the precision and force with which this function is performed in the majority of animals possessing vertical mandibular occlusion, is wonderfully illustrative of the capacity of the animal mechanism for the display of power. The limited amount of tissue of which the apparatus is constructed does not appear capable of the intense manifestations

of force demonstrated. No other single part of the animal structure possesses, dynam for dynam, so much power, even excluding the ratio of size and area; and the capacity exceeds all proportion to the area involved, compared with the average mechanical power of other regions. The arching, the leverage, the static, receiving pillars, and the strong, peculiarly distributed and attached muscular impactors, all quasi-condensed into comparatively limited area about the cephalic alimentary opening, and located on the antero-inferior aspect of the cranium, contain and expend force greatly in excess of other mechanical regions.

"The maximum of area of the masticatory is attained by the herbivorous mammalia, where capacity for motion is more essential than for force direct. Trituration is here an important factor of digestion, especially so in ruminants. The anatomical factors entering into the structural peculiarities of the masticatory region of animals of this class may be enumerated as follows: (1) the construction of the temporomaxillary articulation, allowing lateral, anteroposterior, vertical and oblique movements; (2) the extent of maxillary attenuation developed for the support of extensive masticating area; (3) the suppression of density and diameter of the maxillary bones, thus economizing weight and structure;

Fig. 4.—Another skeleton crib of Magitot (1867).

(4) the predominance of the rotatory over the elevating muscles; and (5) the peculiarity of construction of the masticating armature, the teeth,—i.e., the vertico-parallel arrangement of the dental tissues and the abortion of the crushing teeth.

"Another evidence of the occluding force in man (and one which the dentist and oral surgeon utilize in the important and beneficial operation of the correction of irregularity of the teeth) is the rapidity with which occlusion will cause movement and alteration in position in the alveolus of the teeth. This is observed in almost every denture, in its special manifestations, in causing the natural symmetry of position of the teeth while erupting, and in the too frequent negative evidence of irregularity and malposition owing to premature or retarded eruption. This is accomplished by the occlusion of inclining surfaces, which is so powerful for movement.

"Another indication of the force is the development of the bones and muscles that support the teeth. The growth of the maxillaries exhibits dependence on the occlusion of the teeth for perfect and symmetrical production. Being at birth mere shells containing the active, laboring tooth-forming pulps and growing crowns, as the teeth erupt and mastication comes upon them the bone solidifies

and braces up the forming and formed roots to support the force. When the second denture comes into place the arch enlarges posteriorly, strengthens its substance, develops static force, and its arches and pillars of resistance but become more firm and dense with use. Negative evidence is again furnished by mal- and asymmetrical development, due to irregular eruption of the teeth, and the growth of bone prevented by the loss of the stimulus of occlusion. This force exercises a potent and wonderful influence in the acceleration of the growth of the bones and muscles, and the symmetrical moulding of the face in normal development.

The muscular system is dependent upon the irritation of use for perfect development, and the rising teeth require employment to effect successful eruption. This need is so strongly felt, that the desire to masticate in a child amounts to a passion, a ravenous desire, in reply to an imperative demand from nature. Not only is this true previous to eruption of the teeth, when it is mainly membranous, but subsequently the desire is so strong that its indulgence produces a decided pleasure to the parts. Occlusion seems a necessity to perfect development, for

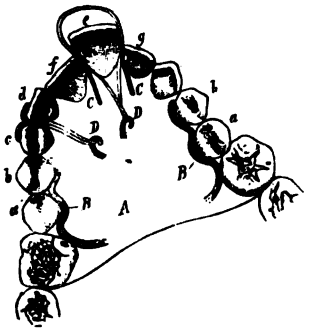

Fig. 5.—Apparatus of vulcanite rubber, as used by Wilpart.

growth depends largely upon the irritation of use, and the desire to indicate a growing insufficiency of employment in the species.

"With the presence of the teeth and their active use, the integrity of the jaws and muscles may be said to be maintained. As these are gradually lost as life passes on, the alveolus rapidly and the maxillaries and muscles slowly atrophy and become reduced. Slight irregularity, visible asymmetry, results, and the final total loss of the denture produces the well-known shrunken face of edentulous persons, especially when aged. This sunken appearance of the masticatory region is not due alone to the loss of the teeth. Suspension of the irritation of use to the parts brings a marked atrophy of bones and muscles, from withdrawal of the nutritive supply and consequent reduction. Asymmetry is frequently observable in persons who acquire the habit of asymmetrical mastication when the teeth are yet present, owing to disease of the latter, or some other lesion, upon one side. The substitution of artificial dentures will not restore atrophied muscles and plumpness of visage, for the reason that the required force can not be sustained, and is not attempted. Valuable lessons might be drawn from this fact in artistic prosthesis. In age, disease usually renders the teeth, when remaining, unable to bear forcible occlusion, and in this way disuse accelerates the ordinary atrophy of senility."

Wilpart, *Vierteljahrsschrift f. Zahnheilkunde*, p. 152, 1877. Wilpart used an apparatus made of vulcanite rubber with small hooks of gold attached to same. To these were fastened elastic rings, which were put on the teeth to be moved. This appliance affords nothing new and is seen in Fig. 5.

Alfred Coleman, before the Odontological Society, Great Britain, 1877, in a paper entitled *"On Certain Points in the Treatment of Irregularities: Extraction Vice—Expansion of the Dental Arch,"* explained the Coffin Plate and its advantages. There was nothing new recorded as to etiology, etc., however, this is the first time we find the Coffin Plate illustrated. George W. Fields, in discussing this subject, says, "For expanding the arch he used the plan spoken of by Mr. Coleman, that invented by Dr. Coffin. It was important to ascertain in

Fig. 6.—Alfred Coleman (1877).

each case the proper position for the spring, so as to get the pressure on the proper teeth. He had known it to cause separation of the median suture in very young children, proving that the spring had some power."

W. E. Hyde, in the *Dental Cosmos*, page 406, 1878, described the following new rotating appliance:

"The 'dipper' wrench, made by fitting the tooth with platinum foil, and afterwards covering with solder, and the 'box' wrench of Dr. Farrar, while both excellent, are, nevertheless, somewhat expensive, and sometimes difficult to apply, while this device can be made in five minutes, and at a nominal expense, and can be adjusted to any tooth. It may be old to others, but in my office it is a two-weeks infant, yet it promises great things.

"Take a piece of fine gold, silver, or platinum wire, five inches long, and bend

it into a double loop, as shown in Fig. 7, 1. Put the point of an excavator through at (*a*) and, taking hold at (*b*) with thumb and finger, twist the four wires into a cable (*c*) (Fig. 7, 2) the excavator making the loop at (*d*). Now cut open the small loop (*e*), and bend the ends back on the long ends as in Fig. 7, 3, and place a bit of solder at (*f*), holding it in the blaze until the short ends are soldered down so as to make a firm, rigid base for the lever (*c*). Pass the long ends around the tooth to be rotated, and bring them back to the lingual surface of the tooth. Fasten securely by twisting together. You have a wrench which can be bent up close to the roof of the mouth, or any desired angle, and will remain perfectly firm. Apply the rubber as usual."

Geo. S. Allan, before a meeting of the New York Odontological Society, November, 1878; *Dental Cosmos*, page 92, 1879, presented a paper entitled, *Protrusion of Lower Jaw and Treatment.* "In April last a little girl brought to me for dental treatment only, but noticing that the lower jaw presented a very marked protrusion, I advised that it should be immediately treated with a view to the removal of what was a positive deformity, and was asked to undertake

Fig. 1. Fig. 2. Fig. 3.

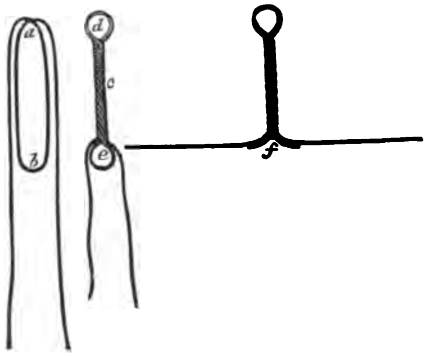

Fig. 7.—Rotating appliance described by W. E. Hyde (1878).

the treatment. The deformity was entirely in the under jaw, which was, as usual in such cases, of abnormal width, and projected so that the lower arch extended outside the upper throughout its whole circuit. Usually, in such cases, I direct delay, before beginning to operate, until the permanent teeth are all in place. But, after consideration, I adopted for this case a different plan. As the irregularity appertained to the jaw itself and not to the arrangement of the teeth, I decided to operate upon the jaw alone, and to bring about a correct articulation of the teeth as a sequence. My first plan was to construct two dental splints or plates of rubber one each for the upper and lower jaws, having a protuberance on each in the nature of an inclined plane, which would act, during closure of the jaws, to force the lower one backward. But I did not persevere in this direction, for I soon found that it would be of little use. Then, directing the child to continue wearing the upper plate, I set to work to make an apparatus that would pull the lower jaw back, keeping the upper splint alone in place. As you will see from the photograph (Fig. 8) taken at the time she was wearing this apparatus, it consists of two parts. For the lower part I made a brass plate to fit the chin, having arms with hooked ends reaching to a point just below the point of the chin. These arms were arranged in such a way that the distance

between them could be altered at will by simply pressing them apart or together. The upper part consisted of a simple network going over the head and having two hooks on each side, one hook being above, and the other below the ear. When this apparatus was completed and in use, there were four ligatures of ordinary elastic rubber, pulling in such a way as to force the lower jaw almost directly backward. I relied upon the elastics attached to the lower arms to do the main work. The upper elastics were simply used to keep the mouth closed so that the lower elastics would not pull it open, the upper elastics being made just strong enough so that the child, in the natural operations of eating and talking, would not have to strain the muscles of the mouth to keep the jaw open. The work proceeded very rapidly, much more so than I had expected, so that at the end of two months, instead of six (as I had told the mother of the child it would take) the irregularity was almost entirely cured. At about the end

Fig. 8.—Head and chin cap devised by Geo. S. Allan (1878).

of the first month there came a stop, and for two weeks I could not get the jaw to move one particle, which puzzled me very much. The mother said the child wore the apparatus regularly, day and night, and she knew of no reason why the work should not go on. I had the child brought down to the office in the morning and kept her there all day watching her, and I found that when she was busy at reading or play, she would push the network on the head back so that the elastics did not pull. Thus that puzzle was solved. I then directed the mother to watch her carefully, and keep the band of the network well on the forehead, and also more carefully directed the young Miss herself and warned her that she would lose all that had been done if she was not more careful in the future. After this the work went on steadily to completion. In a little over two months the under teeth were completely inside of the upper.

"I was puzzled at first to understand how I had obtained so great an amount of recession in the lower jaw, but on carefully examining the skull and position

of the parts at the child's age, the proper solution of the problem soon presented itself. The jaw at that period of life is completely developed and hardened. When a child is one year old the union between the two lateral halves of the jaw takes place, and at eight years the jaw is solid. Consequently any efforts that may be made will not affect the jaw-bone itself. The only way in which the change can be made is by pushing back the condyles of the jaw into the glenoid cavity. Allow me just here to show you the skull of a child about five years of age. The articulation between the glenoid cavity and the condyle is peculiar, in that there is a double synovial membrane between which there is a cartilaginous bursa. This cartilage gives way and absorption takes place at the posterior side of the condyles, with filling in of the anterior, so that the whole operation consists in pushing the condyles of the lower jaw into the glenoid cavity of the temporal bone. Until the articulation has again receded by the natural protrusion of the teeth, I suppose the child will have to wear the apparatus more or less. I had it taken off to bring here this evening. I should certainly in any similar case presented hereafter, even at twelve or thirteen years of age, before attempting any other procedure, try this first and thoroughly."

Thomas Wardle, under *Protrusion of the Lower Jaw, (Dental Cosmos,*

Fig. 9.—Gold plate as used by Thomas Wardle (1879).

1879, page 371) for a young lady of nineteen, prescribes the following method of treatment:

"The arch of the upper teeth was much less than that of the lower, the outer cusps of all the latter were outside of the former, necessitating an expansion of the arch of the upper jaw as well as a reduction of the protrusion. To accomplish the first object a self-acting plate was designed, illustrated in Fig. 9. The plate which was of gold, was made to fit the arch of the mouth as for an upper denture. To this were soldered two posts of platinized gold, set opposite the palatal faces of the bicuspid teeth and about three-eighths of an inch distant from them, their lower ends being on a line with the cusps of the teeth to be acted upon. At right angles with these were soldered oval tubes, closed at their palatal ends by the posts to which they were soldered. To these oval tubes were fitted sliding bars having semicircular clasp-shaped cross pieces neatly fitted to the bicuspid teeth. In the application of this plate to the mouth, small pieces of soft rubber were inserted into the tubes and increased from time to time as required, which maintained a gentle constant pressure, resulting in a short time in the desired expansion of the jaw and a lowering or flattening of the palatal arch about three-eighths of an inch. This little appliance was worn with entire comfort, and the patient soon learned to adjust it herself.

"Previous to any attempt to overcome the protrusion of the lower jaw it was necessary to extract the last tooth on one side of the upper jaw, because of its antagonistic relation to the lower teeth. A cap was made of strong twilled silk, lined with unbleached muslin, covering the head completely, the sides coming a little below the upper part of the ears, and was cut out to fit around them. A chin piece was made of morocco leather, which was lined and fitted to the chin, covering the space between the bicuspid teeth. To the ends of this chin piece were attached straps for attachment to the cap behind the ears. Two other straps were attached to the upper edge of the chin piece, arranged to join the head cap about the center of the attachment of the temporal muscles. The four straps were thus attached to the head cap, divided in their centers, and provided with buckles so arranged as to prevent their coming in contact with the patient's face. The whole apparatus was so simple in its construction that the patient could remove or adjust it at pleasure."

(To be continued.)

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

ROENTGENOGRAMS OF PULPLESS TEETH*

DR. HAROLD O. HANSEN, D.D.S., CHICAGO, ILL.

THERE has been a great deal of criticism recently in dental literature regarding the wholesale extraction of teeth by dentists who have had no special training in the interpretation of dental radiographs and also due to the hasty advice of physicians who hoped the patient would improve as a result of the extractions.

We are daily confronted with patients who present themselves for treatment, and our primary object with every one is to remove infection whether due to unfilled roots or pyorrhea. It is imperative that the patient have a well made set of radiographs of the entire mouth and if any area is doubtful another radiograph should be made at a different angle and it is often surprising to see how differently a condition will appear as the x-ray at best is but a shadowgraph and is never a clear photographic expression of the pathologic condition. Distortions due to varying density of structures and differences due to angles of focus are often responsible for wrong impressions and frequently the x-ray will permit infected areas to pass unnoticed. It is in these unrecognized foci of infection that real danger lies, especially if after the x-ray has shown no appreciable pathological change and the patient is assured that the x-ray shows nothing. When as a matter of fact there may be the foci of infection there, that may be the cause of considerable systemic trouble. So it behooves the roentgen operator to employ every precaution in obtaining radiographs possessing rich detail so that a definite scientific diagnosis may be made.

Too often the size of the area above a pulpless tooth is taken as an indication of the amount of harm that might result which is entirely wrong as the most virulent infections are usually found in the smaller areas. Again an area of in-

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creased transparency instead of meaning that it contains an active infection may contain a granuloma where the old abscessed condition has undergone the process of repair or may still contain infectious matter ready to spring into full activity upon the slightest irritation.

Schuhmann has recently stated that other sinus shadows over teeth are due to the fact that in the process of devitalizing and treating teeth many times drugs are employed which act as strong escharotics and the result may be a coagulation of lymphoid matter over the root end which will appear as a darkened shadow over the apex of the tooth. So exercising all the care and skill an individual can in the passing of judgment on dental radiographs he will still make a few mistakes but when in doubt always let the old slogan "safety first" be your guide and extract. I also feel that no one is justified in passing judgment on a set of radiographs without seeing ahe patient or at least having a full history of the case and more definite results will be obtained if radiographs are studied while examining the mouth, also having thorough knowledge of the patient's general systemic condition.

No matter how well a root may be treated and filled there is still an element of doubt as to whether or not there may be some hidden infection there and Rosenow makes the statement that every devitalized tooth has an area of lowered resistance about the root end and should be considered unsafe.

Beginning or inflammatory changes of bone infection are not discernible in the radiograph as it does not at once produce gross bony liquefaction. After several days or weeks there is sufficient decalcification for recognition: so when an area is found over an apex it is hard to determine the length of time infection may have been present.

In the face of these facts in order to insure safety for our patients it is necessary to continue with extractions but instead of being condemned hastily as in the past we now feel inclined to weigh carefully the radiographic and clinical findings and take into consideration the personal equation and when we conscientiously exercise these precautions no unnecessary extractions will be done as the medical profession are now leaving these serious questions to the dentist who has an understanding of roentgenographic pathology.

It is not my purpose in this short paper to attempt to discuss all that would come within the scope of this field but to limit myself to these three phases, namely:

1. Indications for the extraction of teeth. 2. Indications for treatment. 3. Indications for keeping under observation.

In the first classification I will mention a few conditions in which we find pulpless teeth that we can with impunity remove. All pulpless teeth which are not necessary for cosmetic reascns and of no use in mastication should be extracted. In this class will be mostly third molars around which will also be found pockets harboring bacteria due to the fact that there is usually not enough space to completely erupt and the tissue overlies the enamel surface but can not attach. All teeth which show a definite area of infection on a patient who is beginning to show evidence of the absorption of toxins should be relieved of these infected areas as it is nothing short of criminal to allow them to remain and as a consequence have a heart lesion or an impaired joint.

All pulpless teeth over which there is a cyst, removal is usually necessary and also the entire cystic membrane to prevent too great a loss of bone due to the continuous pressure of the cyst wall on adjacent structure and often becoming secondarily infected, causing a great deal of trouble.

Teeth which have been treated and the walls of the canals perforated, the usual result being an alveolar abscess, should be removed.

In the process of treating teeth one often encounters a condition where it is impossible to gain access to the infected area through the root canal, due perhaps to the fact that a phalanx of cement has been forced into the canals which can not be removed, also broken broaches are often met with high in the root which can not be taken out, so the tooth should be extracted.

Any tooth where the pulp dies before the roots have attained their full growth, leaving a wide open root end, invariably are seriously infected and should be taken out.

Impacted teeth under most conditions should be extracted but I will not go into this subject as it is too lengthy for consideration here.

Teeth infected from pyorrhea where the radiograph shows the bone structure gone to any extent should be taken out but this is a subject in itself and worthy of a paper on that alone.

Under the heading of teeth to be retreated, I will mention just a few conditions where this can be safely done.

Moorehead says that less than ten per cent of dentists are able to do reliable root canal work due to lack of technique and proper training in so highly a specialized operation requiring a knowledge of medicine plus aseptic surroundings and a great perseverance, requirements which are possessed by only a few.

Teeth which have only an indefinite area about the root end where the canals can be opened may be treated and filled but the x-ray should be used to show the work properly done and another radiograph taken about a year later to see that no further trouble has developed. In patients who are in the best of health one may attempt treatment in teeth showing large areas but often in these conditions the root ends are roughened and to insure freedom from reinfection a root resection should be performed which is usually successful if well done.

In the classification of pulpless teeth to be kept under observation I have many in mind where the root end is very small and the canals may not be properly filled and where there is no evidence of infection over the apex, and the tooth perfectly comfortable. If these teeth are opened and treated and the root end enlarged it is subject both to hemolytic infections, and infection introduced from without, and better left untouched. These teeth should however be radiographed a year or so later and if still in the same apparently safe condition will beyond doubt remain so indefinitely. In this class the upper bicuspids are the most frequent.

In the darkness and doubt of infections of pulpless teeth and the demand for "more light" we find our only solution in the prevention of these conditions is to avoid the initial introduction of caries in tooth structure and this can be done by strict prophylaxis. Dentistry in the past fifty years has made wonderful strides and the men responsible for this progress are worthy of highest praise. In the past, however, nearly every effort has been to repair lost tooth structure

with but little thought being given to prevention. In the new era upon which we are entering, when prophylaxis will be practised and preached, we will have mouths where every tooth is highly polished instead of broken down and infected. At least 90 per cent of decay and 95 per cent or even more of the dead pulps will be prevented and the patient have teeth beautiful to look at, as well as representing the maximum in masticating efficiency, and comfort, with absolute freedom from pyorrhea and gingivitis. This Utopian period in dentistry is bound to come as it is the very essence of common sense, but will come much sooner with the earnest cooperation of the medical profession.

A DISCUSSION OF WHAT HAPPENS IN A ROENTGEN TUBE*

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President of the Western Roentgen Society

In order to form a conception of what happens within a roentgen tube, one must understand something of the nature of matter and especially those elements of matter entering into the construction of a roentgen tube, as well as electricity.

In this paper, I propose to discuss briefly and as far as possible separately:

1. The Anode or Anti-Cathode
2. The Cathode
3. The Electrical Discharge
4. The Cathode Ray
5. The Roentgen Ray

My discussion of the roentgen ray will be very brief in this paper and will be concerned only with what seems to be the most useful theory of its production at the anode.

The kind of tube upon which I wish to base my remarks principally is the hot cathode or coolidge tube. In this connection, I wish to say that in my judgment, we as roentgenologists owe our greatest debt of gratitude to Dr. W. D. Coolidge, excepting only W. C. Roentgen, the discoverer of the rays themselves.

The Coolidge tube as it stands to-day marks the greatest step in advance in the science of roentgenology since Roentgen discovered the rays.

Aided by such co-workers as Hull, Davey, Moore and others, Dr. Coolidge through the experimental laboratories of the General Electric Company continues to be our most potent and productive source of scientific achievement for roentgenology.

The coolidge tube is superior in almost every respect to any other form of roentgen tube.

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THE ANODE (ANTI-CATHODE, TARGET)

Several points are to be considered in discussing the anode. Because of its high atomic weight tungsten has been almost universally adopted for this purpose It has an atomic weight of 184.0.

The atom of tungsten at ordinary temperature shows very little tendency to liberate negative electrons. It is this property which makes the hot cathode type of tube capable of carrying an electrical discharge in one direction only.

Tungsten is also suitable anode material because of its high melting point, which is about 3400° C. in the atmosphere.

Tungsten also possesses high thermal conductivity. Comparing with platinum as 0.35 to 0.17. This property accounts for the rapid distribution of the heat generated at the focal spots throughout the mass of material in the anode and thereby permits a small focal point so essential in clinical roentgenology, described so nicely by Kreugler.

Tungsten also possesses a high radiation value and compared with platinum is as 91 to 100.

Tungsten has a low vapor pressure at very high temperature. It shows evidence of volatilization at about 1800° C. Melts at 3400° C. and boils at 3700° C.

CATHODE

A study of the cathode is closely interwoven with the study of the electron and the electrical theory of the constitution of matter. This theory is the most serviceable basis for our best explanation of the origin of roentgen rays and the physical reasons for the properties of radioactive substance, such as uranium and radium.

Until the coolidge tube was introduced, we were concerned with various physical phenomena within the roentgen tube. This has now been entirely eliminated. The hot cathode type of tube as introduced by Dr. Coolidge in 1912 depends entirely for its operation upon the thermionic emission from the cathode.

In the old type of tubes various metals were used in the cathode. The most suitable kind of cathode material was generally conceived to be aluminum. It was found to be especially adapted for this use because of its atomic construction. Its atoms possess vast zones of loosely combined electrons as compared with platinum and tungsten. This fact aided greatly in maintaining its position in the electrical discharge as the cathode pole.

Aluminum delivers electrons more freely as the temperature rises. The heat generated at the cathode during an electrical discharge in a vacuum tube is roughly proportional to the amperage of the current used in the discharge. It is evident then that aluminum automatically adjusts itself in liberating electrons to meet the demand made upon it at the cathode pole. It will be readily observed that if the amperage is sufficient, the heat generated at the cathode will be high enough to melt the aluminum, and the molten portions would be found to fly away from the cathode and become flattened out against the glass on the opposite side of the bulb.

If the cathode and anode were constructed of the same materials or metals they would also present the same capacity for liberating electrons and would be equally balanced in their tendency to allow the current to pass in both directions.

Aluminum was also found suitable because its volatilizing power was high, in fact almost as high as the melting point. It also has the property of liberating hydrogen when heated to a degree sufficiently high to force it to give up its gases.

Hydrogen has been found to cause very little if any damaging phenomena in the tube unless liberated from the metals in considerable quantities.

Inasmuch as it is my purpose to discuss almost entirely those phenomena in a roentgen tube of the hot cathode type, I will reserve further discussion of the cathode as presented in a coolidge tube until later in this paper.

ELECTRICAL DISCHARGE

Any complete description of an electrical discharge in a vacuum tube must involve a consideration of the production of the current and of what it consists.

In this connection, I would like to present a few brief statements. Most of us remember the study of two kinds of electricity—*positive and negative.* Bodies with similar electrical charge repel one another. Bodies with unlike, that is, positive and negative charges, attract one another. (Fig. 1.)

In the analysis of matter, we may recall that bodies are composed of mole-

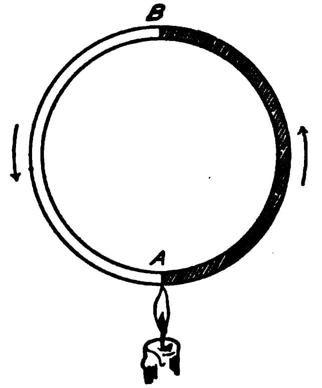

Fig. 1.—A THERMO-ELECTRIC CIRCUIT. This is a symbolic drawing. The circle as a whole represents the complete electrical circuit, the left half being composed of a metal which emits electrons freely and the right half of one which parts with its electrons less easily. If the junctions *A* and *B* are both at the same temperature no current will flow, since the tendency towards a clockwise current which exists at *B* is exactly balanced by the opposite tendency existing at *A*. However, when the junction *A* is heated these tendencies are no longer exactly in equilibrium and electrons move around the circuit in the direction of the arrows. It is not necessary that the circuit should be made up of equal masses of only two different metals. It may be broken at any point and long wires of any sort of conducting substance introduced without altering its general principle. (From Comstock and Troland.)

cules. These molecules are of almost every conceivable shape. They depend for their properties upon their number, nature and geometrical arrangement of their atoms. Such enormous numbers of variations are hereby possible as to permit the formation of a vast number of different substances. For example, there are now known several hundred thousand substances in which the molecules are composed for a part at least of carbon, and that the other elements in these molecules are but three in number—hydrogen, oxygen and nitrogen. Undoubtedly many other molecules than those now known with carbon are in existence and await further work for their discovery.

At the present time our knowledge covers about one hundred distinctly different atoms. If one substances is found to attract another substance, it indi-

cates that the atoms composing their molecules have unlike electrical charges.

The atoms depend for their electrical charge upon their electrons. The atom consists of a nucleus and electrons.

The nucleus possesses always and under all circumstances a definite positive charge of electricity. Very little more is known concerning the nucleus of the atom.

Surrounding the nucleus are vast numbers of negatively charged particles called *electrons.* These electrons may be thought of as surrounding the nucleus in different zones or fields. Certain zones are held very firmly by the nucleus. To remove electrons from these zones would greatly alter or cause destruction of the atom itself. Other zones of electrons are held by the nucleus more feebly and it is in these zones that electrons may be detached and removed or added to the atom without greatly altering the general nature of that particular atom.

The size of the electron is very small as compared with the size of the atom. As an illustration, it has been stated that if an atom were thought of with a diameter of 100 yards, its electrons would be approximately the size of a pinhead. (Fig. 2.)

Fig. 2.—THE RELATIVE SIZES OF ATOMS AND MOLECULES. This diagram is intended to give an idea of the relative magnitudes of atoms and molecules. However, the drawings are only symbolic, as the dimensions have been calculated on the assumption that the molecules are spherical, which cannot be strictly true. It will be noticed that the smallest atom (that of hydrogen) differs only slightly in size from the largest atom (that of uranium). The starch molecule is probably one of the largest which exists and it will be seen that, according to the diagram, it is very much larger than the largest atom or than the molecule of sugar. The relative weights of the particles represented are as follows: Hydrogen, 1; Uranium, 239; Sugar, 366; and Starch, not accurately known but probably about 25,000. A molecule of ordinary alcohol weighing 46, would be slightly larger than the uranium atom. (From Comstock and Troland.)

If the nucleus with its positive charge of electricity has sufficient electrons, the atom becomes electrically neutral. If this number be decreased, it then possesses a positive charge. If the electrons were increased, it becomes negatively charged. (Fig. 3.)

Electricity exists in the form of the power of electrons seeking an unsatisfied nucleus. An electrical current means a movement of electrons towards a positively charged center. As stated before, only certain electrons or perhaps zones of electrons in the atom are capable of leaving the nucleus without alteration or destruction of the atom.

The attraction which is manifested by some classes of atoms for an electron is much greater than others. Metals as a class show very feebly atomic attrac-

tion for electrons. As a class of substances it will be readily observed that metals are excellent media through which electrons may be transported or in other words metals are good conductors of electrons or electricity.

If a current is passed through a metal, say a copper wire, it indicates that electrons were introduced at one end of that wire and delivered at the other end of the wire.

The speed which electrons assume in the conduction of a current through metal must not be confused with what has been termed the *speed of electricity*. The actual movement of the electron in metallic conduction is in fact infinitesimal to the speed of electricity. In this case electrons move at the most but a few centimeters per minute. The speed of electricity is very close that of light (186,-300 M. per second). It consists of an impulse to move passed from one electron to another. This might be illustrated by placing two billiard balls upon a table

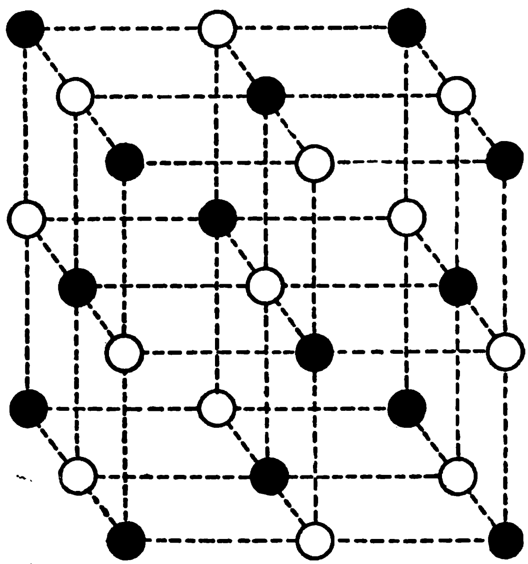

Fig. 3.—STRUCTURAL PLAN OF A SIMPLE CRYSTAL. This drawing represents the structure of a crystal of potassium chloride, a substance similar to ordinary salt, as deduced from its action upon x-rays. The dark spheres represent chlorine atoms, the light ones atoms of potassium. It will be seen that the unit of structure of the crystal is the individual atom, since all of the atoms are equidistant from their immediate neighbors. For the sake of clearness, the spaces between the atoms have been exaggerated, as compared with their diameters. (From Comstock and Troland.)

a definite distance apart and permit the ball struck to cross the distance to the second ball and deliver its message to move. If the distance between these two balls were composed of a direct line of balls, the impulse to the last ball to move would occur in a very short space of time after the first ball received the impact. In the case of an ocean cable, an electron might be years traveling from New York to London while under proper conditions an electron at the New York end set in motion is noted in the electrons at the London end of the cable but a small fraction of a second later.

While the illustration answers very nicely for the passing of a current through a metallic conductor, the space between the two poles in a vacuum tube is very different.

As an electrical current is discharged into a vacuum tube, there must be an

actual movement of electrons since the distance between the two poles is not bridged by atoms through whose electrons the electrical impulse may be passed.

It is evident then that an electrical discharge into a tube with rarefied atmosphere or any form of roentgen tube causes for the main part a liberation of particles with similar electrical negative charges.

In the hot cathode or coolidge type of tube there are few if any positive ions liberated from the anode. There is no appreciable generation of heat at the cathode except that due to the filament current. The vacuum is so nearly complete and the metals so nearly gas free that under all temperature this tube may attain in ordinary work, there are no phenomena of interest other than that arising with the thermionic discharge currents.

The walls of the coolidge tube possess a negative charge differing in this respect from other types of tubes.

The speed which the electrons assume in passing from the cathode to the anode determines the wave length of the roentgen ray thereby generated. The more rapidly the electron is moving when making a contact with the atoms of the anode, the shorter the wave length thereby generated. The speed which the electrons assume in the coolidge tube depends as in all other tubes upon the potential difference of the two poles at the time of the discharge.

Each electron as it passes on its course from the cathode to the anode represents a particle with a definite negative charge of electricity and possesses its radiating line of electrical force.

In the coolidge tube the discharge is purely electronic and of thermic origin. The number or rapidity of their discharge depends entirely upon the degree of heat at the cathode. They are liberated from the heated spiral of tungsten in the cathode. They are concentrated upon the anode in a focal spot.

The number of electrons leaving the cathode determines the amount of milliamperage of current passing through the tube. Again it may be noted that in the coolidge tube electrons are not interrupted on their way from the cathode to the anode by the presence of ions or atoms from gases within the tube.

CATHODE RAYS

The cathode rays represent the electrons delivered into a vacuum tube from the negative pole of a suitable electrical current. These electrons have the cathode in abeyance of the forces of attraction to the anode.

The weight or mass of these electrons is said to be about 1-1800 part of the smallest known atom—that of hydrogen.

Their speed varies greatly, but generally it may be said to be about one-tenth that of light.

Their shape is said to be spherical when traveling at low speed, but that they become oval or flattened when traveling at a speed approaching that of light.

It has been shown that they leave the cathode at right angles to the surface of the cathode pole. They travel in straight lines until they are interrupted in their course.

They are capable of passing through solid substance, even through atoms themselves.

Cathode rays can be bent out of their course by the action of a magnet. They also respond to the action of an electrical field in much the same manner as that of a magnet, except that they are deflected at right angles to the direction they assume when passing under the influence of a magnet.

While cathode rays are by far the most conspicuous and the most important rays present in a tube, there are other rays which deserve mentioning.

In tubes containing rarefied gases, there have been described positive rays or canal rays. These rays travel in the reverse direction to the cathode rays. They represent ions which in the course of events have become detached from the anode and pass through the cathode stream or rays to the cathode.

An ion is an atom from which certain of its electrons have been removed leaving it with a positive electrical charge. It has been shown that a small portion of the positive rays are deflected in their course in much the same manner as cathode rays by the action of a magnet or an electrical field. The lines of their deflection however are in opposite directions to the lines of deflection noted with the electrons under the same influence. This fact corroborates the supposition that they have a positive charge. It has also been shown that they are much greater in masses or inertia. They probably reach the size of a hydrogen atom.

Cathode and positive rays can be demonstrated very nicely by placing a bead of lithium chloride in the tube when it will show a blue fluorescence by the cathode rays and a red fluorescence on the side facing the anode from the positive rays.

Positive rays have ionizing, fluorescing and photographic action.

It is evident from what has been said that in old or aluminum cathode type tubes, there are no cathode rays streaming over to the anode until the atoms in the anode have been deprived of certain electrons to the positive side of the dynamo, which generates the current. Then, from the negative side of the dynamo the cathode will become overfilled with negatively charged particles. At this instant positive ions are liberated from the anode seeking negative particles. They will, of course, bombard the cathode. It is this bombardment which accounts for the heat generated at the aluminum cathode. The heat generated at the cathode is about one-fourth that generated at the anode in this type of tube.

The whole process of liberating electrons from the cathode is dependent upon the positive ion bombardment and the subsequent heat generation. It is these positive ions which do not reach the cathode but are attracted to the glass surface of the tube and deliver a positive electrical charge to the wall of the tube when in action.

ROENTGEN RAYS

As the electron leaves the cathode en route to the anode, it represents a moving body possessing a definite electrical charge. Any body possessing an electrical charge is surrounded by a zone of electrical force radiating from the body in all directions.

If the charged particle or body is moved from one position to another, it carries its lines of electrical force with it. As it moves it must take a direction parallel with certain lines while at a greater or lesser angle to all other lines, inasmuch as the lines extend in all directions from the body.

After a charged body is set in motion and continues to move at a constant speed in a straight line, it becomes surrounded by the same zone or field of force lines with the same properties as when the body is at rest, and not influenced by or exerting influence upon any other body.

If this charged body is interrupted suddenly in its course, the lines which radiate from it continue to move in the same direction until the effect of the interruption of the central charged impulse reaches them. This impulse or news of the interruption moves along these lines of electrical force with the velocity of light. This impulse or news of the interruption to the central charged particle has been described as kinks in the electrical force lines. These waves represent electrical waves or light waves.

It is the speed with which the kinks or waves in the electrical force lines follow one another that gives quality to light. The slow wave representing hertzian or heat waves. The shorter waves may represent visible light, ultra violet light, roentgen rays or finally the rays of radioactive substances.

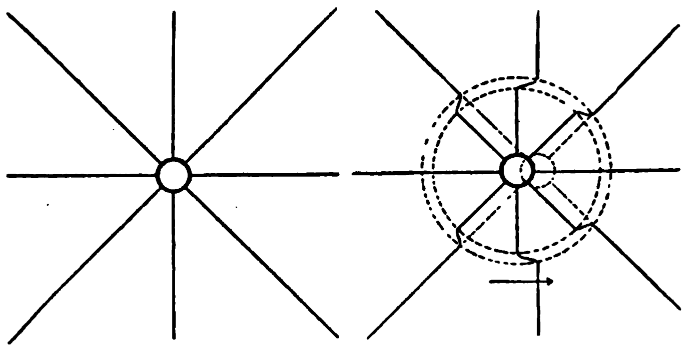

Fig. 4.—TO SHOW HOW RADIATION IS PRODUCED BY STOPPING THE MOTION OF AN ELECTRICAL PARTICLE. The diagram at the left represents a charge of electricity with its radiating lines of forces. We will suppose this charge with its lines to be moving uniformly in the direction indicated by the arrow in the diagram at the right. When the charge is suddenly brought to rest the "lines" have a tendency to continue in motion, and do so until, so to speak, the news of the stopping of the charge has reached them. This "news" travels outwards from the charge with the velocity of light, along with the "kinks" in the force-lines which result from the discrepancy between the actual and the "expected" position of the charge. These kinks contain electromagnetic energy and constitute light and other forms of electromagnetic radiation. Such radiation is produced whenever any change whatsoever occurs in the state of uniform motion of an electrical charge.

All light whether it be the sun or the heat or hertzian waves travels at the same speed, but it possesses different wave lengths. Hertz waves of wireless telegraphy are over a mile in length, while the violet ray (the shortest visible ray), has wave lengths of about one ten-thousandth of one inch in length.

Roentgen rays depend for their wave length upon the speed at which the electron is traveling when it makes contact with the anode. It is the atoms of the anode which furnish the interruption to the electron, causing the kinks in their lines of electrical force and thereby generating roentgen light.

Where the potential difference at the two terminals within a tube is great, or as we may say the voltage is high, the electrons assume a very high speed in traveling to the anode. The interruption produces therefore a shorter wave in its force lines. On the other hand, low potential variation means low voltage and longer waves. Rays with short wave length possess great penetrating power, and as the wave becomes longer the penetrating power is decreased.

The wave loses its effectiveness as it passes on its course from the anode. This loss is estimated as varying inversely as to the square of the distance.

Not all rays emanating from the anode are of similar wave lengths. Certain waves are generated as the electron reaches the first atoms of the anode. The electron reaches the first atoms of the anode. The electron probably passes through the first zones of electrons of the atoms of the anode, even through the atom to the deeper layers of atoms. Each point where its speed and course are interfered with represents a ray of different wave lengths. Each wave after the first interruption will be of longer wave length and consequently less penetrating.

If electrons could reach the anode at a speed equal to the beta particles of radium, it would seem that we would be able to generate roentgen rays whose wave lengths would be as short as the gamma ray of radium. (Fig. 4.)

DISCUSSION

Dr. Heber Robarts, Belleville, Illinois.—I have always been of the opinion that science. of which physics is a branch, should be obscure only to those in pursuit of phenomena. Once a thing discovered and understood the laws should be made plain to every one.

Contrary to the notion that a current of electricity runs through a wire from the generating apparatus is that the current is always there. Of course, the current is the electron and the electron is at the cathode. The molecular composition of the conducting medium is accelerated and in ratio of their acceleration, together with the heating at the cathode, does the electron speed away. When the apparatus rests the electron is static and becomes kinetic the moment the current is generated.

In an x-ray machine the generating apparatus is at one end and the crookes tube at the other. The electron at the generating source does not leap through the wire to the cathode and thence to the anode—it simply pushes off the electron at the cathode. If the velocity of the electron is greater than 5,000 miles a second at the time it strikes the anode an etherial wave or electromagnetic wave is evolved which represents the roentgen ray. The striking effect of the electron, which is measured by the square of its velocity. determines the speed and number of x-rays. The speed of electron in a good working hard x-ray tube is 10,000 miles a second.

At the moment of transformation of an atom of radium there is discharged an alpha particle and an emanation; and the emanation in its several periods of transformation expels alpha particles, discharges beta particles and radiates gamma rays. The beta particle is the electron and has a speed of 150,000 miles a second; the gamma ray has the speed of light with the phenomenon of constancy. It has a short wave length which gives it a penetrating power one hundred times greater than any other known ray.

There is discharged from a good working hard crookes tube 1,000,000 x-rays every second of time. From a gram of radium there is radiated 3,000,000,000 gamma rays every second of time and with mathematical constancy.

Now the striking effect of a particle of matter is not proportional to its velocity, but the square of its velocity. Then the electron which causes the x-ray in a crookes tube moving at a rate of 10,000 miles a second, and the beta particle which causes the gamma rays moving at the rate of 150,000 miles a second, then the beta particle strikes with an energy 225 times greater than the electron.

Dr. B. H. Orndoff, Chicago (closing).—There is nothing to say in closing other than to reiterate that the roentgen rays consist not in the discharge of particles from the anode, but that it represents waves or kinks in electrical force lines and that these waves or roentgen rays are light waves. The rays of light generated at the anode in a tube from the sun or from any other apparatus are waves in electrical force lines and that they travel at the same speed. The quality of light depends entirely upon the wave length. There is much to be said about the different kinds of light designated as roentgen rays, but the scope of this paper will not permit me to speak further of that at this time. I wish in closing to express my gratitude to Dr. Robarts for the discussion he gave my paper.

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EDITORIALS

Stepping Out in Front

RECENTLY, while a member of a party composed of men who belonged to the Rotary Club we attended a theatrical party. Among the Rotary members was a theatrical producer who during the performance enlightened us very materially upon the life history of some of the theatrical people. One of the performers was a young lady, very well known in the theatrical world not only for her ability as a performer, but because of the rapid rise in her profession. The theatrical producer was familiar with her professional life from the time she had entered upon the stage until the present time and described her success as being due to the fact that as a member of the chorus she was continually "stepping out in front."

We were enlightened as to the fact that "stepping out in front" among the

theatrical people when applied to a chorus girl described a condition of the individual who has a certain amount of ability and ambition and instead of staying back in the line even with the rest, insists upon displaying that ability by getting a few feet ahead of the legitimate chorus. This may be rudely termed "nerve" when not accomplished with ability, but when accomplished with ability is very soon recognized by the theatrical producers and the individual is given an opportunity to display her real talent and ability. As a result of this, the particular young lady in question is now playing a leading role, leading the same chorus which she was formerly a member of, all because of the fact that she insisted upon "stepping out in front."

When we consider the dental profession as a whole, we are surprised at the large number of individuals who are content to stay in the background and play a minor part in the development of their profession and never once have the ambition or ability to "step out in front." It has been said by a great many writers that there is plenty of room at the top, and we can truthfully say this in regard to the advancement in the dental profession; there is plenty of room for men out in front. For a number of years we have observed dental college work, and have seen class after class graduate and go into the practice of dentistry. The majority of them have been a success in so far as they have been able to make a better livelihood in the practice of the profession than they could in any other line of work. However, the majority of men have been failures so far as showing any real ability in leading the profession and distinguishing themselves by "stepping out in front." We have seen men who criticized the dental profession, found fault with the profession they were following, and even have gone so far as to belittle the profession because they have not been satisfied with their position. The reason they occupy that position is because they have placed themselves in it.

The dental profession, like the theatrical profession, has plenty of room for the individual who has the ability and the ambition to "step out in front." We realize it may require a large amount of hard work, because nothing that is worth while ever came without extraordinary effort. If you stop to consider the men in the dental profession who have attained international reputations for their ability and if you were permitted to know the inside history of why they have succeeded, you would find it has been because they have never been content to play a minor role and always bent their efforts towards doing something a little better today than they did yesterday. Each day they have tried to improve their efforts and tried to grasp opportunities and do something that would be worth while to themselves, and in doing that they have invariably produced something worth while to dentistry.

We have very little excuse for the man who is dissatisfied with his position and still willing to keep a position in the "back line" instead of exerting himself and making himself capable of playing a principal part by "stepping out in front" of the masses and demonstrating that he has an ability greater than the ordinary individual. We believe there is no line of work or profession in which a man's ability is so readily recognized by his fellow workers and by the public as in dentistry. In certain commercial lines men are able to advance only as they succeed in showing their ability to the men who are superior or above them. In the

dental profession there are no superior individuals, each man is allowed to work out his own salvation and when he shows ability, he is immediately recognized by his coworkers and he does not have to satisfy any superior officer. Not only is his ability recognized by his coworkers, but it is immediately recognized by the public and consequently the position the man occupies in the dental profession is the position that he makes for himself. We wish we could make every young man realize the opportunities he has for advancing himself in his profession, and that those advancements depend upon him entirely; if he would succeed, he must keep this one thing in view; namely, to demonstrate his ability to the profession and the public by "stepping out in front."

Modern Dentistry*

THE name of this book, "Modern Dentistry," suggests that it deals with the subject of dentistry as practiced at the present time. The title to a certain extent is misleading as it should be "Head on Modern Dentistry" because the entire volume is a treatise of the author's ideas rather than a treatise of the subject of modern dentistry. We agree practically with everything that is written in the book especially the statement in which he says: "Henceforth no appliance however beautiful externally shall be tolerated unless it can be kept absolutely clean, and no repair of a tooth or root will be countenanced unless it conforms to the standard of scientific mouth hygiene." He also makes a plea for better trained dentists along medical lines by the following statement: "Dentists henceforth must be trained along medical lines and any contention that has existed in the past between physicians and dentists must disappear in a common endeavor to free the community at large from the deadly effects of mouth infection. For this disease is now recognized as an almost universal one; that every year directly or indirectly by the hundreds of thousands and it is the author's hope that this book will be of some service in its cure and prevention." The question may naturally arise whether mouth infection may be classed as a disease in itself any more than any type of infection may be considered a disease. Probably if we take the broader view of this proposition any tissue when it loses its normal function is a diseased tissue, and in that respect we can consider mouth infection a disease.

The first chapter deals with the cause and effect of mouth infection and contains a great many points of interest most of which we can agree with. We are especially pleased with the attitude that the author takes in considering mouth infection from both a systemic and local standpoint. In times past there has been a tendency when writing upon mouth infection to consider it either as a local proposition or go to the other extreme and consider it entirely from a systemic point, when as a matter of fact there is such a close correlation between the systemic and local cause and effect of mouth infection that it is very difficult to say in some cases which one is the cause and which the effect. In some instances mouth infection may be the cause of systemic disturbances and in other

*Modern Dentistry, by Joseph Head, M.D., D.D.S., Dentist to the Jefferson Hospital, Philadelphia, Pa. 374 pages, 309 illustrations. Published by W. B. Saunders Company, Philadelphia, 1917. Cloth, $5.00.

conditions systemic disturbances may precede the mouth infection. These views as explained by Doctor Head are worth the attention of any one and if the book contained nothing but the first and second chapters, it would be a valuable addition to any library.

In considering the conditions which cause mouth infection, we must note, however, that the author has omitted malocclusion as a contributing factor of mouth infection, for it is the opinion of a great many men at the present time that malocclusion is one of the greatest causes of mouth infection. Also as a preventive of mouth infection he fails to give the proper importance to the protective influence of the epithelial tissue which is the greatest means of protection from and prevention of the invading of microorganisms that we have. Practically all cases of infection that we find are the result of some break in the epithelial structure from some cause, thereby permitting the microorganisms to invade the underlying tissues. The use of the silk floss and brush is explained in detail which also is a valuable portion of the book.

Chapter III deals with the study of tooth enamel and saliva, and gives a large number of experiments carried on by the author in regard to softening and hardening of the enamel. These experiments are very interesting and the author seems to hold the opinion that the normal saliva has a very beneficial effect upon the enamel of the teeth.

The various plans of the treatment of mouth infection are taken up, including the local and systemic treatment, the use of bacterial vaccines and the use of bifluoride of ammonium compound in the softening of tartar and the scaling of teeth. This latter method has been written on and advocated by the author a great many times in dental journals in the last few years and in our mind possesses a great many advantages over other methods.

Chapter VI deals with the treatment of root canals, alveolar abscesses, and similar conditions. In conjunction with the consideration of the treatment of root canals the author calls attention to the experiments made by Dr. Gies of Columbia University which tends to prove that the tooth is nourished through the medium of the peridental membrane and that a tooth in which the pulp has been removed is by no means a dead tooth as is contended by a number of the dental and medical profession at the present time. We are very pleased to note this for we have long contended that a tooth with the pulp removed can still be a serviceable tooth and must not be considered as a foreign element as some of the profession have told us at times. A quotation from Dr. Head's work follows: "Such a tooth is very much alive and should not be looked upon as dead but as a living member capable of performing its various functions."

The chapter on Fillings is decidedly the idea of Dr. Head on the subject and he takes the position that will be disagreed to by a great many men; namely, the universal condemning of malleted gold fillings. It is a fact, as he states, that a great many gold fillings with perfect edges have lasted over fifty years, but it is also a fact that a great many more did not last one-tenth of that time. We believe that his plea for the inlays both of gold and porcelain and the use of cement and proper cavity preparation is in keeping with the ideas of modern dentistry. The thing which we would criticize both in the chapter on fillings and on crowns is the poor illustrations. Most of the illustrations have very little

resemblance to anatomic tooth forms and very little attention is paid to the function of the tooth form. The illustrations of the various crowns fail to show the anatomic contour and the proper reconstruction of the gingival marginal ridges which are very important factors if the crown is to perform its physiologic function.

There is a chapter on the care of children's teeth, a portion of which is devoted to the subject of orthodontia. The orthodontic portion is written from the standpoint of a general practitioner, but can hardly be classed as modern orthodontia. Most of the appliances which are shown are more or less obsolete at the present time, and the models are such as are generally made by the average dental practitioner. The treatments advanced may be the proper orthodontic treatment and in that respect it is a valuable addition to the book.

The replacement of lost teeth by various forms of attachments is considered and there is also a chapter concerning experiments on various cements. Chapter XII deals with the study of the roots and gums by means of the x-ray, and a number of very interesting cases are shown. The book as a whole contains many valuable points and a great many theories are set forth with which probably some readers will not wholly agree. The book is one which should be recommended more to the general practitioner than to the dental student, owing to the fact that it is simply a treatise on modern dentistry from Dr. Head's standpoint, and as such we would recommend it to any one who is capable of thinking clearly upon a certain subject. The value of any book lies not so much in the fact that you agree entirely with what the author says, but that he succeeds in making you think more deeply upon the subject than you have in times past.

Our Hawaii

THAT large group of Americans who have not been privileged to visit Hawaii are under obligations to Charmian Kittredge London for the interesting and valuable information she has given to them in her recent book, "Our Hawaii" (The Macmillan Company, New York).

The Londons, Jack and Charmian, knew our Island States, the Hawaii group, as few Americans are privileged to know it. It was their playground. They acquired an intimacy with it and with its people during the months spent voyaging inland and cruising around its coast line, and this knowledge the author has set forth most interestingly to her readers.

Mrs. London has done more than write a book of travels about these islands and their people. She has given a dissertation, reliable and scientific, upon an integral part of our country—a part, let it be said, of which the average American knows but little. Most of us are familiar, by tradition at least, with the wooden nutmegs of the Connecticut Yankee, the flannel sausages of the Vermonter, the barbecued meat of the Southern planter, and the rodeos of the Texas rancher, but how many of us know anything about the beautiful but simple customs of the Hawaiians, their large and generous hospitality, the friendship and devotion they show to the stranger within their gates. Of all these things Mrs. London writes interestingly and well.

The author's style is deserving of special notice. In a book of this character imagination is brought but little into play. It chronicles actual happenings, and these frequently are commonplace and make dry reading, but like the French chef who disguises unpalatable foodstuff with tasty sauces and attractive garnishings, so does a charming and attractive style dress up a narrative that otherwise would not attract. Mrs. London has a style that is all her own. It reminds one of the nip and exhilaration of champagne that has ripened in some dark and musty cellar in immortal France. It is said that one soon forgets the gaudy butterfly, but the remembrance of the bee with its sting remains. Mrs. London's style makes an impression so deep upon one that it is not easily forgotten. "Our Hawaii" is one of the real literary gems that has appeared within the last twelve months. After reading it one is prone to murmur the immortal words of Leigh Hunt: "May thy tribe increase."

American Society of Orthodontists

THE Eighteenth Annual Meeting of this Society was held in Chicago, August 1, 2 and 3, 1918, under the presidency of Dr. D. Willard Flint, Pittsburgh, Pa.

Interesting papers were read and freely discussed. A new constitution and by-laws were adopted.

The following is a list of papers read at this meeting:

"The Forces that Influence Structural Development of the Face," by Dr. Alfred P. Rogers, Boston; "A Consideration of Some Principles of Appliances," by Dr. Martin Dewey, Chicago; "The Law of Occlusion," by A. LeRoy Johnson, Springfield, Mass.; "The Removable Lingual Arch as an Appliance for the Treatment of Malocclusion of the Teeth," by John V. Mershon, Philadelphia; "Democratizing Dentistry," by Dr. Allen H. Suggett, San Francisco; "Radical Tooth Movement," by Dr. Ray D. Robinson, Los Angeles; "What Orthodontia and Orthodontists Have to Offer to Our Own as Well as Allied Sciences," by Dr. B. W. Weinberger, New York; "Orthodontia Metals and Alloys; the Metallurgy, Constitution and Physical Properties of Dental Gold Alloys, and their Special Application in Orthodontia," by Mr. Louis J. Weinstein, New York; "Stereoscopic Roentgenology," by Dr. C. Edmund Kells, New Orleans; "The Teaching of Orthodontia to Undergraduates," by Ralph Waldron, Newark, N. J.

The following officers were elected: President, Dr. O. W. White, Detroit, Michigan; President-Elect, Dr. John V. Mershon, Philadelphia; Secretary, Dr. F. M. Casto, Cleveland, Ohio; Treasurer, Dr. Bert Abell, Toledo, Ohio; Board of Censors: F. C. Kemple, New York City, Chairman; M. N. Federspiel, Milwaukee, Wisconsin; and Lloyd S. Lourie, Chicago.

St. Louis, Missouri, was selected as the next place of meeting, and the time of holding the meeting to be fixed for the last week in February or the first week in March, 1919.

Oliver W. White, D.D.S.,
President of the American Society of Orthodontists, 1918

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ORIGINAL ARTICLES

FRACTURES OF THE MANDIBLE*

BY A. A. SOLLEY, D.D.S., SAN FRANCISCO, CALIF.

PROBABLY this paper may not be of interest to all men engaged in orthodontia. In the last six or seven months I have been doing quite a bit of fracture work. This paper has been the outcome of the present conditions throughout the world.

In studying over the various methods in use today on the fronts of Germany and England, I was rather surprised to see the resemblance the appliances bear to our orthodontic appliances.

In presenting this paper I wish to state that it is merely a summary of information gathered from various papers, principally the *British Dental Journal,* and various books published on oral surgery; viz., Blair, Marshall and Brophy. In many cases the authors' exact writings have been used to more forcibly express the ideas. The subject I believe to be a timely one, and inasmuch as the mechanical technic in the reparative treatment of our subject bears a close relationship to orthodontia, I thought it might be of interest.

During the last three years I have had many cases of fractured jaws under my care, but in considering the fact that the fractures of the war zone were as a class not simple, but of a multiple, compound or complicated nature, the question occurred to me—what line of procedure would I follow were I, as an orthodontist, forced to treat some of these cases? It is with this in mind that I offer this paper.

England, France, Italy and Germany have established special hospital units for the treatment of all oral surgery cases. Today those suffering from injuries of the face and jaws are looked upon as heroes, but later are objects of dread if not properly treated, and the treatment can not even at its best, be always car-

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., February 18, 19, 1918. The editor regrets his inability to obtain the illustrations used in this paper.

ried out along ideal lines suggested by those drawing their experience from ordinary practice.

The surgeon should keep in mind the prime necessity of dental splints, and the dentist that treatment is required beyond the mere adaptation of splints. In the beginning of the war complaint was made of the ordinary bandage used primarily as a temporary dressing. It is conceded that at the dressing station the simplest means must be adopted to cover the wound and arrest bleeding; but the wounded were often left for hours or even days at the field or base hospital without the bandage being renewed. It becomes soaked with saliva, discharges and liquid food, and forms a germ-breeder of the most dangerous type. Unless a splint has been inserted, the bandage gives no support to the broken bones; indeed, if a bandage remains for a period, drawing the chin backwards, the broken fragments are dislocated distally and produce a deformity of the face giving a birdlike appearance. Further, the soft tissues are deprived of their nourishment, giving rise to suppuration, sloughing and cicatricial contractions, that necessitate extensive plastic operations subsequently. Adhesions form between the mucous membrane of the lips, tongue and cheeks and the soft tissues over the jaw, which have to be stretched or divided before splints or any prosthetic apparatus can be used.

The first aim in all severe cases should be directed towards saving the life of the patient, and not until this is insured should splints be adapted or other surgical measures carried out. The next step should be directed towards insuring union of the jaw; if this can be carried out by restoring the contour of the jaw and occlusion, all the better, but if, by endeavoring to restore the contour of the jaw and occlusion, a risk is run of obtaining nonunion, then the ideal should give way to the practical, for it is far better for an individual to have a firm mandible and a moderate amount of malocclusion than an ideal shaped bone which is unable to bear the strain of mastication. The masticating surface in a mandible with a malunion can often be easily rendered efficient by artificial dentures.

At the oral hospital begins the combined work of the surgeon and dentist. Plate radiograms are taken to ascertain the condition of the bones and to discover any portions of metal in the soft tissues that may have become embedded; also films of the immediate seat of injury, as well as models are taken. All dead tissue and separated pieces of bone and any teeth separated from their attachment are removed as shown by the radiogram. All living tissue is carefully preserved, the basic idea being to remove all irritation from the bone. If the wound is clean its edges are sutured provided this does not present technical difficulties; on the other hand, if the wound be suppurating and if the damage be great, with or without the opening of adjoining sinuses, then the treatment begun will be continued. Daily, two or three times, especially after meals, the wound and mouth will be thoroughly syringed out with weak solutions of hydrogen peroxide or permanganate of potash and the gums are swabbed with a 2 per cent solution of iodine in alcohol. The recovery of the wound rapidly follows, but of great assistance is the exciting of a better blood supply, by exposure to sunlight or artificial light, associated with massage of the tissues. These aids to increased nourishment of the tissues are largely used at Dusseldorf, Germany, both before

and after plastic operations, and it seems that by these means the sloughing of pieces of tissue, portions of flaps, are often prevented.

The next step is to anesthetize the patient and examine the character of the injury and see how far reduction of the fracture is possible. The necessary septic teeth are removed, as well as the teeth bordering on the line of fracture; the importance of this latter step will be referred to later. Any sinuses present are also examined and treated, but no attempt is made to remove necrosed bone unless it has sequestrated. The necessary splints are made and adjusted if needful under an anesthetic. When healing of the bone is complete, the splints are removed and a simple retention splint inserted, and the patient may be said to have reached the convalescent stage.

If the man is immediately returned to his depot he will find himself unable to cope with ordinary food and will therefore go "sick." To avoid this and gradually accustom him to acquire the power to bear the brunt of efficient mastication, he is taken through a graduated course of diet. In civilian practice the construction of such a series of diets is easy, but in military life it has to be drawn up from the variety of foods coming within the limit of army regulations as follows:

1. Fluids; 2. minced; 3. boiled; and 4. ordinary.

1. Milk, beef tea, chicken broth, supplemented by "extras," to be ordered when necessary for the treatment of the case (*vide* regulations).

2. Minced chicken, and minced ordinary diet, supplemented with minced fish, eggs, and semifluid puddings.

3. Boiled ordinary diet supplemented by fish, eggs, suet puddings, toast.

4. Ordinary diet in accordance with the regulations.

It is found that patients who have sustained jaw injuries rapidly lose weight; hence the provision of suitable diets becomes a matter of first-rate importance. The patient must be carefully dieted, not only to increase his weight and strength, but also in order that full advantage may be taken of the mechanical advantages of a graduated diet in bringing about increased muscular movements and restoration of the functions of the jaw, supplemented by massage and other mechanical means.

Most writers protest against attempting to wire the bone in fractures of the lower jaw. This is not justified in civil practice, unless it can be done aseptically as in simple fractures (which do not occur in the horizontal ramus of the lower jaw). In this War the vast majority of fractures are the result of bullet wounds, and there is always some comminution. Cases are mentioned and illustrated where cure was long delayed on account of unwise attempts at wiring, and only commenced after the wire had been removed. The oral surgery of the Balkan wars, 1912 to 1913, bears this out.

Similarly, the attempt to fix immediately prosthetic appliances, or troughs, to the bone by wiring is condemned. The results attained in Tokio during the Japanese War were by no means satisfactory (though in the cases of those who lived to reach the hospital malunions had already occurred, and attempts were made to render life endurable to these pitiable objects, after dividing the malunited bone, by wiring troughs or prosthetic appliances to the separated ends of the bone). Even the immediate stitching up of an extensive, contused wound

of the soft tissues of the face is questioned, and in every case is condemned if associated with injury to the jaws, unless and until a splint has been inserted.

When there is little loss of substance and the bone, if fractured, is not displaced, then the early insertion of sutures appears to be demanded, since otherwise the displaced soft tissues tend to shrink and form adhesions with neighboring tissues. On the other hand, many wounds have not healthy edges and are infected, hence primary union seldom occurs. Often a general anesthetic can not be given and the local anesthetic as used in the field seldom seems efficient, indeed it apparently increases the inflammation of the tissues. The circumstances are generally adverse to an aseptic, workman-like operation. The sutures (usually of silk) frequently cut out, damaging the tissues and diminishing the amount available for the subsequent plastic operation. The recollection of the pain endured indisposes the patient to subsequent operative procedures. It is advised that if immediate sutures seem advisable, if field conditions are not favorable, that the fracture be attended to and that the wound should be painted with iodine and the adjacent skin covered with oil of mastic (mastic dissolved in benzol); a piece of gauze should be lightly placed in the wound and the wound fixed with strapping or by a four-tailed bandage loosely tied. The mouth should be frequently washed out with peroxide of hydrogen; in default of this, water is better than nothing, and the patient should be rapidly transferred to the special hospital. (The distressing dryness of the mouth can be alleviated by use of a lotion consisting of glycerin 400.0, spiritus dil. 50.0, anisi 0.2, ol. menth. pip. 0.2.)

Although fractures of the mandible formed 44 per cent of the gunshot injuries to the bones of the face in the Japanese-China War, no proper arrangements existed for treatment of these in the war with Russia. As a rule, a bandage was applied by a comrade or by the wounded himself, and the treatment in the field and base hospitals was at least inadequate, possibly wrong. This was the more regrettable as Hashimoto* recognized that "with gunshot injuries of bones in other parts of the body the patient may be content with the healing of the wound and consolidation of the fragments, and not often ask further surgical help. The healing powers of Nature do the rest, and disturbed function is compensated by vicarious movement. But it is different with bone injuries of the mandible; these need quite a different technic, a portion of which is in the domain of dental surgery. The finer points of treatment are undertaken by the dental surgeon, the army surgeon contenting himself with occasional superficial help. The function of the mandible, the chewing of food, is prevented by relatively slight displacement of the bony fragments; this does not happen with other bones. If, as not infrequently occurs, suppuration follows and necrotic fragments must be removed, the wound may luckily heal but the 'bite' will be spoiled, on account of the displacement of the bony fragments, and this renders the mastication of food almost impossible. The consequence is impaired nutrition. On account of the actual damage to the soft parts, pus flows out of fistulous openings into the mouth, and the patient swallows these deleterious products. Shortly, the lasting metabolic disturbances, partly through swallowing toxic compounds, partly due to faulty feeding, together with the conse-

*Viscount T. Hashimoto, General Staff-Surgeon of Japan, 1908.

quential alteration of the facial contours, call to mind the cachectic condition coincident with a malignant growth."

The displacements in fractures of the mandible are dependent upon the direction of the force causing the injury, the extent of the injury, and the action of the muscles. Fractures in the region of the molars are accompanied by a depression of the anterior fragment and a swinging over to the affected side, the posterior fragment being usually drawn upwards and inwards. It is to this latter displacement that particular attention is drawn, because according to one of the British writers, advantage may be taken of it to assist healing. In civilian practice the posterior fragment is, as stated, usually drawn upwards and inwards, but in gunshot injuries the impact of the projectile often forces the anterior fragment inwards, and the posterior fragment moves forwards and passes outside the anterior fragment.

In the majority of cases we have to deal with a loss of tissue and we have the following condition present: the posterior fragment is drawn upwards and meets the opposing teeth and the anterior fragment slews round to the injured side. If the upward resistance to the posterior fragment is removed by the extraction of the posterior teeth, the fragment will move still further upwards, but at the same time forwards, and so bridge over the gap of lost tissue. The recognition and utilization of this forward movement is of great practical importance in obtaining union.

A common type of injury is for the bullet to enter the molar region on the one side and find an exit by the molar region on the other. In such cases we may meet with the following displacement: the posterior fragment on the entrance side is drawn upwards and overlaps the anterior fragment, the latter being drawn well backward and over to the "impact" side and considerably depressed. On the exit side the posterior fragment is drawn upwards.

The extreme displacement that may be present in this type of injury is here described. The man had been under treatment for over three months before being admitted to the Croydon Hospital, England. The mandible was fractured on the right side in the region of the first molar; there was a severe fracture on the left side; the right central incisor was in contact with the first molar which was lying horizontally along the margin of the right posterior fragment. The central fragment which was fractured in a horizontal direction was lying across the mouth.

In cases of injury in the incisor region the resulting displacement varies considerably according to the loss of bone. If the loss of bone involves the body of an alveolar process to an equal extent, the two halves of the mandible approximate and we have a parrot-like jaw, but there is little, if any, falling inwards of the fragments. In cases where the loss of the base of the jaw is slight compared to the alveolar process the following displacement occurs:

The two halves of the mandible approximate and engage at the lower part, and there is but slight loss of "chin." The external pterygoids and the mylohyoids tilt the lateral fragments inwards, and when this has occurred to the extent that the buccal cusps of the lower teeth are lingual to the lingual cusps of the upper teeth, the action of the "bite" is to accentuate the lingual movement of the fragments. In this man there was but slight loss of bone along the

lower border of the bone, but there was extensive loss in the region of the alveolar process. This is a type of deformity that can easily be overcome and avoided by prompt insertion of interdental splints.

Fractures of the ramus are accompanied by a deviation of the mandible, to the affected side, accompanied by a marked upward movement, the degree of upward movement corresponding to the loss of tissue.

A common cause of nonunion is the presence in the line of fracture of septic teeth. When a fracture runs between two teeth, the periosteum of the teeth is usually destroyed and a pocket is formed and a stagnation area created. Sepsis follows, and union, even under the most favorable conditions, is often delayed, and, even when union of the bone does occur, the pocket remains, and sooner or later leads to loss of the teeth. On account of this condition many oral surgeons have made it a practice to remove the teeth on each side of the fracture. In many of the cases of nonunion which have been admitted to the various hospitals the cause has been traced to septic teeth in the fracture, the removal of which has been followed by rapid healing.

An important cause of nonunion is want of rest of the fragments. This is typically seen in fractures about the molar region when interdental splints have not been used. In these cases the tendency is for the posterior fragment to be drawn upwards, and the anterior fragment downwards. When the mandible is at rest the teeth occlude; when an effort is made to close the teeth the posterior fragment is pushed down, and the whole series of teeth brought into occlusion. The effect is a constant see-saw action of the fragments and therefore nonunion.

In one case reported injury occurred on March 22, the first molar being carried away. No dental treatment was considered needful, and the patient arrived at Croydon early in November, with the fragments freely movable. The right lower second bicuspid and molars were removed to give rest to the posterior fragment, and within three weeks the fracture had consolidated so that no movement could be obtained.

Fractures in the region of the rami are frequently followed on the repair of the injuries by a considerable interference with the movement of the mandible, due mainly to contraction of scar tissue. The method of treatment by the use of the wooden screw gag is not satisfactory and one has found that a more efficient method is to forcibly stretch the tissues over definite periods followed by rest. The plan adopted is to screw open the mouth at night, the gag remaining in until the morning. The diet, too, should be of a hard character.

A disadvantage of the screw-gag is that it may force the mouth open in an oblique direction, and this is obviously undesirable; the aim should be to ensure an equal distribution of force. This is obtained in the apparatus which was suggested by Captain H. M. Holt. It consists of two curved plates covering the occlusal surfaces of the teeth, the plates being united at each end by screws. The appliance is adjusted to the mouth and the plates are opened to an extent "just not to cause pain."

Associated with injuries of the jaws there is frequently considerable laceration, and in some cases destruction of the cheeks and lips, healing of the wounds being often followed by a depressed cicatrix attached to the jaws. The

soft tissues thus bound down not only considerably restrict the movement of the parts, but at the same time are extremely disfiguring.

In many of the cases plastic operations are necessary, but these operations are not so likely to be required, or if necessary, are more likely to be satisfactory, if the scar tissue is first severed from the jaw and subsequently stretched and massaged. Warm olive oil applied several times daily is very beneficial.

The plan that is being adopted in these cases is as follows: When possible models of the mouth are obtained and a vulcanite splint is constructed to bulge out the soft tissues in the region of the cicatrix. The splint is made so as to firmly occlude with the upper teeth. The cicatrix and the adjacent soft tissues are freely divided from the bone with a pair of scissors, the separation being made close to the bone. While the patient is under the anesthetic the splint is placed in position and modelling composition firmly pressed in between the separated parts, and the construction of the splint is completed. The wound in the mouth is then packed with gauze and the vulcanite splint placed in position within forty-eight hours. Additions are made to the splint from time to time until the soft tissues are in a state of full tension. The stretching of the tissues is assisted by regular massage.

The results that are obtained from this line of treatment are satisfactory. With some patients the opening of the mouth is limited to such an extent that it is impossible to obtain satisfactory models for a large internal splint. In such cases a piece of vulcanite is prepared to pass into the sulcus between the bone and the lip, the vulcanite being attached to an external splint. In one patient the lower lip was firmly adherent to the bone, and the opening of the mouth was extremely contracted. The lip is now supple, the depressed cicatrices have flattened out and dentures have been inserted.

In many of the cases one feels that the delay has been mainly due either to entire neglect to utilize interdental splints or to the nonrecognition of certain underlying principles of treatment. If cases can be brought under proper dental treatment soon after the receipt of injury, one can look forward to rapid and good recovery.

In every case attempt is made to bring the teeth into normal occlusion; when bone is lost, and if, after treatment, a radiogram does not show any new bone formation (although from the description one gathers that this very frequently does occur, even when the ends of the bone are somewhat widely separated), then, subsequently, a bone-graft is inserted.

Lindemann states that in seven months from the beginning of January, 1915, he performed sixty-three cases of bone transplantation. All these were done under a local anesthetic, and of these fifty-six healed absolutely primarily and seven secondarily.

They cut the ends cone shape; these are then inserted into holes drilled in the ends of the fractured jaw. They insist that the essentials to success are: absolute fixity of the portions of jaw by means of splints; a small operation wound, so that the ends of the bone stumps only are exposed and not separated from the surrounding soft tissue; imbedding the transplantate in as much of the surrounding soft tissue as possible before the skin wound is stitched up; the absence of foreign bodies to fix the fragments and awaiting the complete healing

of wounds, etc., before undertaking the operation. Another way of fixing the bone is to cut each end wedge shape, and to slide it into notches cut in the bone stump.

When the fractured portions are not freely movable they are brought into place:

1. By the intermaxillary traction of rubber rings.
2. By the pressure of a screw fastened to a divided metal cap splint.
3. By the force of two metal lever arms attached to the teeth by anchor bands and rings and extending out of the mouth, where, after crossing, the ends are joined by rubber bands.

Sometimes the ligamentous union and the cicatricial tissue between and around the fractured ends are divided with a knife before the correction of the misplacement is commenced.

Intermaxillary traction with rubber bands is only of use when the resistance is not great. Its great advantage is the very different directions in which its force may be applied.

Lindemann prefers to perform all plastic operations of the soft tissue and all bone-grafts under the influence of local anesthesia. He regards this as preferable to general anesthesia, since the latter, either during the administration of the anesthetic or during recovery therefrom, is likely to be associated with some disturbing factor, sickness, movement, etc., inimical to the success of the operation.

In every case he uses novocaine with the addition of suprarenin. In severe cases an injection of morphia is given from fifteen to thirty minutes before the operation. Only powdered nocovaine is used, i. e., no "tabloids," etc. The distilled water obtained is redistilled. The suprarenin is added shortly before the solution is to be used.

For simple cases a purely local injection suffices, but for extensive operations (plastic operations, bone-grafts, etc.), the injection must be into the nerve supplying the region. A 2 per cent solution of novocaine is used with 1 drop of suprarenin to 1 c.c. From ½ to 2 c.c. of the solution is required. The more accurately the nerve is reached, the less is the solution required. The position at which the nerve is to be injected (primary division or branch) will be determined by the extent of the field of operation. Sometimes two neighboring divisions must be injected, and in operations in the midline of face both right and left divisions. The duration of the anesthesia is about an hour and a half, but sometimes lasts two hours.

When in a fractured mandible no teeth are present in the posterior fragment, movement of this is limited by twisting roundthe free end of a somewhat longer wire to form a loop. This loop is embedded in a lump of gutta-percha, which rests on the gum of the edentulous fragment, or is wrapped up in iodoform gauze.

For use with wire, bands to encircle the teeth are kept in eight sizes. These bands are deeper and thicker than Angle's bands, and also differ from the latter in that the clamping screw has a tube drilled through its long axis, into which passes the wire of the splints.

The use of impression material in, or without a tray is well known as an

emergency splint. Trays of various sizes without handles but with wire loops soldered to the convex surface of the tray serve for the attachment of straps or bandages which can be passed under the chin or over the top of the head. Black gutta-percha is mostly used.

The splints used in Frankfort are on the lines of orthodontic and fixed apparatus. Displacements were corrected by means of expansion arches and screws, rubber bands, intermaxillary traction, and sometimes head and chin caps connected by elastic bands.

The use of the combined method is recognized in fractures of the maxilla, and for those of the mandible when no teeth are present, but, as at Dusseldorf, Germany, the method has been extended to other cases. The method is adopted for the correction of displacements. When the fragment is in the corrected position, the extra-oral appliance is removed and the intra-oral splint relied on, or altered, to act as a retentive apparatus.

In all cases the fixed point is a wire, or wires, passing downwards from a head bandage; sometimes a plaster bandage and sometimes a bandage with wires encircling the head. The vertical wires are straight, or end in a loop to allow the fixed points to be varied as required. When there is a loop, a second wire is used to steady it. The traction is by rubber bands.

When the bone defect is in the midline it is possible not only to check the tendency to displacement inwards, but also to pull the fragments forward or backward. As previously stated, the form of splint commonly used is the wire splint, one for the maxilla to form the fixed points and one for each portion of the fractured mandible. It is recommended that these splints should be wired to each tooth to obtain absolute fixation. A series of hooks are soldered to the labial and the lingual wires of all the splints to enable the elastic rings to be fixed in any position required. As in most instances the traction should be in a horizontal direction, a wire loop is soldered to the upper splint, which bends downwards to about the level of the articulating surface of the upper teeth. The elastic band, to obtain horizontal traction, is fastened to the labial hook of the upper splint, passes then over the loop and is attached to the lingual hook of one or other of the mandibular splints. When the portions of the mandible are luxated into position a piece of strong wire, bent to shape across the cap, is securely ligatured to the splints on the mandibular fragments. It serves as a retainer till bony union forms, or a bone-graft be completed.

A useful attachment to the wire splint is designed by Schroder to prevent backward displacement of the mandible. A vertical rod is soldered to the lower wire, which fits in a hood soldered to the upper. Metal flanges are also used, soldered to the wires, upper and lower, to act as an opposing force when unilateral movement is desired.

When the rubber bands would not exert sufficient force, an expansion screw is used attached to metal caps. The vertical plates shown not only prevent over-expansion of the fragments, since, when the normal position is reached, they lock against the lingual surfaces of the upper teeth, but they secure bilateral symmetry, because if one side moves more rapidly than the other, its further movement is prevented when it has reached its proper place.

The splint with lever arms is used in cases of extreme resistance. The direc-

tion of the force is regulated by the position of the arms. When the bone is in the correct position, the arms are soldered together with soft solder at their point of crossing, and the portions beyond are cut away. After a time the splint is removed and a retention apparatus, caps joined by wire, is cemented to the teeth.

A form of lever to be used when the jaws can not be separated on account of cicatrices is also used. The rigid wires are fixed to metal cap splints cemented to the teeth, the splint being struck up to a model obtained by forcing open the mouth with a screw wedge. For this purpose an ordinary wooden paper clip is commonly used at Dusseldorf.

The movement in the lower form is caused by the traction of a rubber band attached to the two hooks. It was designed for use when the oral orifice is contracted after plastic operations, especially those undertaken to form a new lower lip. If only a one-sided action be required, it can be obtained by attaching one side to a band round a tooth, this point being fixed, the other moves.

The Gunning Splint is the name given to a splint which embraces both upper and lower teeth. It can be constructed in vulcanite or metal, and finds its best use in cases where there is lateral deviation of the mandible.

The Skull and Mandibular Splint.—An extremely useful adjunct to the interdental splint consists of a skull cap woven out of thick mercerized cotton and bordered by a rim of braid about three-quarters of an inch wide. Two nooks are fitted on each side in front and one behind. The mandibular splint is made from metal and can be fashioned to various shaped mandibles. At the ends the metal is turned over to form catches. The metal cap is connected with the skull portion by cord or tape and according to the pressure exerted one may obtain an upward or a backward pull. This splint is used extensively as an adjunct to interdental splints, with a view of supporting the mandible and so giving rest and comfort to the patient.

Concerning splints to be applied in the field, the utility of ready made bands and wires is mentioned, but some suggestions are made to be adopted in emergencies.

One is formed of wire, about a yard of which can be cut off any wire fence to be met with in most places, and can be shaped by hand, no pliers being essential. It is fixed to the military cap. It is applicable to a case where the front portion of the mandible is torn away from the posterior portions. The front fragment drops downwards, with the attached muscles of the tongue, impeding breathing and swallowing. When the splint is fixed, breathing becomes free and swallowing is facilitated. Moreover, the dangerous swelling of the tongue and neighboring soft parts does not occur. A ligature attached to the teeth is tied to the forepart of the wire. The designer (Hauptmeyer) has used it repeatedly in the field.

Cases in which the front portion of the lip and jaw are broken away and hang down should be supported by means of a sling of rubber dam fastened by strips of bandages to the military cap or to a bandage.

Bruhn is of opinion that splints should be made for each case, but he admits the utility of anchor bands and bars for application in emergency, as in field hospitals. At Dusseldorf, Germany, they are also used in cases where the

condition of the patient prevents an impression being obtained, but are regarded as temporary expedients, to be replaced later by other forms of splints. It is pointed out that one difficulty in the use of this form of splint is that the fractured surfaces often separate when the mouth is open.

The tin splint consists of two or three pieces hinged posteriorly. If there is any tendency of the mandibular fragments to lateral movement, guiding flanges are built up on one side or on both, inside which the maxillary teeth close. To wire the splint to the teeth, slots are cut in the lower border of the lingual and labial portions to correspond with the spaces between two teeth, say between central and lateral incisors of both sides. A wire ligature is then passed between these teeth, leaving a large loop lingually. The splint is then placed in position, and the wire placed into the slots. This is then pulled tightly; the loop lies in a horizontal groove cut in the splint. The labial portion, or portions, are then adjusted, the wire being placed in the labial slots, twisted tightly, and the ends turned down. If there be one or more spaces between the teeth, a hole can be drilled through both lingual and labial portions of the splint and the two fixed together with a bolt and nut.

The indication for the use of this splint is limited and confined to recent fractures with movable fragments, in each of which are several and fairly long teeth. The advantages claimed are the ease of its manufacture and fixation; the facility with which it can be removed for cleansing and reapplied. Bruhn states that, to satisfy the criticisms of visitors to the hospital, he has several times removed a number of splints, taken haphazard, which had been in place for many weeks. In not a single instance was the gum inflamed or red, nor could any effect upon the enamel be detected as would have been the case had the splint been made of vulcanite.

In the Berlin Hospital von Sauer's wire band, as modified by Schroder, is used. This is a single wire 2 mm. thick, of iron or, better, of aluminum bronze; to this the teeth are ligatured with fine aluminum bronze wires. If one side of the mandible is tilted inwards the wire is fitted closely and ligatured to the normal side, but is away from the teeth on the displaced side. Traction is exerted on the displaced side by rubber bands passing from the wire to the teeth, just as on applying an E. Plain arch.

From this paper you can see what position the orthodontist can fill in the carrying out of the treatment of gunshot wounds of the face.

DISCUSSION

Dr. Cavanagh.—Dr. Solley's paper is strictly up to date and in keeping with the times, and it gives us a foretaste of what is going to come to us when this war is over. With the amount of surgery being done at the present time, unless we take the hint and limit our practices to those who are under eighteen years of age, we are going to have many mutilated cases of malocclusion after the return of these men. Our opportunities for patriotic service will probably continue for a long time after the war is over.

Dr. Carter.—I am hardly prepared to discuss this paper intelligently. Dr. Solley has certainly covered the subject very thoroughly, and it shows he has gone into this particular kind of work to a great extent. I have followed the work being done in Europe, somewhat, through our dental magazines, and I have been impressed with the belief that the practice of this particular kind of work has been revolutionized, and the experience the boys who go over to France are getting, is going to be of tremendous advantage to the dental profession all over the world. The American dentists especially have been

covering themselves with glory. I have heard directly that some of the surgeons in France have almost marveled at the operations the American dentists are carrying on, and they have been astonished at the results obtained. As a consequence, the standard of American dentistry (which has always been high in Europe) is increased to a considerable extent.

The experience that a man on the front would get in a very few months, or in a year or so, would probably be more than he could possibly get ordinarily in a lifetime of experience in general practice. Inasmuch as this work seems to be within the field of the orthodontist to a great extent, I believe that Dr. Solley's paper is timely, and that it might be of advantage to many of us to look into this particular line of work a little more thoroughly then we have done in the past.

Dr. Scott.—There is no question but oral surgery is within the scope of the dentist and of the orthodontist. It is conceded these days that the average medical man is incapable and does not possess the knowledge to cope with the situations arising from fractures of the jaw, superior or inferior. Almost weekly—almost daily in fact—cases come under our observation that show that medical men in dealing with fractures of the mandible are handicapped by a lack of knowledge, not of the anatomical parts of the region involved so much as to what they are subject to. I think sooner or later they will revise this. The dental man possesses more specialized knowledge than the medical man, and therefore it is within his scope to handle these cases. A year ago I had the pleasure of listening to some talks by two doctors of Harvard University, who had returned from the western front of Europe, and their talks and pictures were exceedingly interesting. They had handled cases in the hospitals near the front. I remember the account of one patient particularly, where the superior maxilla had been almost entirely shot away, and the doctor, being very ingenious as a prosthetist, had arranged a device which to me was very novel, and I believe it was so regarded by almost all the audience. It resembled a pair of spectacles more than anything else. There was no way of getting attachment to the upper jaw. So he used two pieces of metal, which passed backward and over the ears to hold the appliance in place. As he said, it was not particularly beautiful, but the patient, through its use was permitted to masticate food to a certain extent. I think he also had a restoration of the nose, which formed a part of this appliance,—all of which he showed by photographs.

Dr. Solley.—Personally am much interested in this side of our specialty, and probably through the fact an opportunity was offered me several months ago to go in this capacity. When that offer was made I realized I lacked the experience. I would not have known where to turn nor how to handle these cases had they been presented to me, and the only thing left me was to perfect myself along these lines, as I feel personally, the need is coming and that the need will be great. In the last six months I have put myself in the hands of two prominent surgeons in this city, who have been kind enough to assist me in several minor operations. Thus I am trying to perfect myself in the technic of this work. I have carried on many cases here, the character of which permitted me to follow out any ideas I might choose along these lines.

THREE TYPES OF FRENUM LABIORUM

By Martin Dewey, M.D., D.D.S., Chicago, Ill.

Head of the Department and Associate Professor of Orthodontia in the Dental Department of the University of Iowa.

THE frenum labiorum is composed of mucous membrane and connective tissue located at the median line of each lip, and unites the lip with the gum. In ordinary conditions the frenum labiorum exerts a certain restraining influence upon the lip and only in certain abnormal developments does it become a factor in the production of malocclusion. When the frenum becomes of sufficient size, or has such peculiar attachments as to produce separation of the central incisors, we then consider it abnormal. The cause of the abnormal attachments of the frenum has not received very much attention. In fact, very little has been said as to what has been the cause. Some writers have classed the abnormal frenum as being congenital, having been present since the birth of the individual, while others seem to consider it an acquired condition. From my observation I am led to believe that the abnormal frenum in some instances may be congenital and in others it may be acquired.

In explanation of the foregoing statement, we will say that if one will examine a large number of frenums in young children before the eruption of the deciduous incisors, one will find that in practically all of the cases the frenum is attached at the occlusal border of the gum tissue, or rather, at that portion of the gum which will be the gingival border when the teeth erupt. With the eruption of the deciduous incisors and the corresponding increase in length of the alveolar ridge, the teeth and gingival portion of the gum tissue and alveolar process grows occlusally and the attachment of the frenum assumes a higher point as regards the gingival margin of the gum. However, if as the teeth and alveolar process increase in length the frenum also grows occlusally, then the attachment of the frenum will persist between the incisors and consequently produce a separation of those teeth. Where we find the frenum separating the deciduous incisors it may be considered as a congenital condition, which has persisted in existing after the eruption of the teeth, by the fact that the frenum has grown occlusally as the teeth and alveolar process have grown occlusally instead of assuming a position more apical as related to the teeth. In those cases where the frenum seems to be acquired we find that the abnormal frenum makes its appearance about the time of the eruption of the permanent incisors. This is caused by the fact that as the permanent incisors begin to erupt and the alveolar process supporting those teeth develops, the frenum grows occlusally at the same time that the permanent incisors do; consequently, at the time of the eruption of the permanent incisors, we find the frenum has grown occlusally to such an extent that it assumes a position between the incisor teeth. In such an instance as that we may correctly term such an abnormal frenum as being an acquired characteristic.

In examining a number of frenum cases, we have found three distinct types which may be represented roughly by the following illustration:

In Fig. 1 we find a type of frenum in which the central incisors are separated an equal distance between crown and root; that is, the incisors occupy a proper vertical position in the dental arch and the apices of the teeth are separated as much as the crown. The frenum is of a certain width extending from the highest point of attachment down to the gingival margin. This type of frenum may or may not be associated with open suture. The frenum extends in between the teeth and lingually to a point slightly anterior to the anterior palatine foramen.

Another type of frenum is illustrated in Fig. 2 in which the frenum is attached at the gingival border of the gum between the teeth, and the attachment does not extend very far apically. The result of this gingival attachment is that the incisors are separated at the crown more than they are at the apex, making the crowns of the centrals flare away from each other.

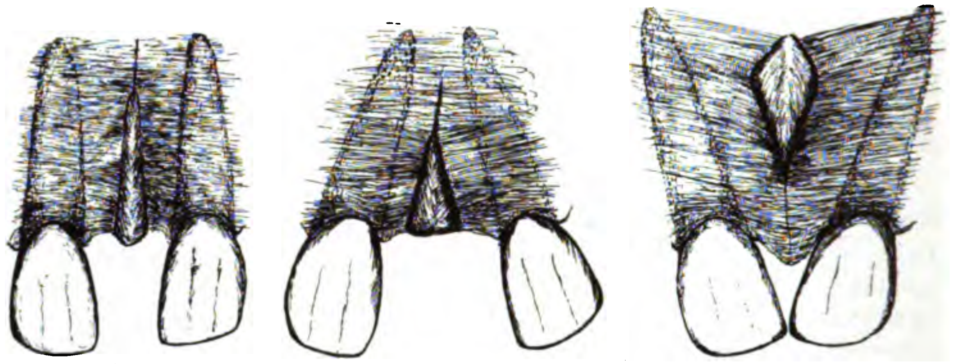

Fig. 1. Fig. 2. Fig. 3.

A third type of abnormal frenum is that in which the attachment is apical and does not extend entirely to the gingival margin. With this type we find the frenum runs in between the roots of the teeth and extends to the lingual border of the alveolar ridge, and by pulling the upper lip the fibers of the frenum can be seen to make traction on the tuft of gum which is anterior to the anterior palatine foramen. These fibers of connective tissue running through between the roots of the teeth in that manner produce a separation at the apex that is greater than that at the crown. In fact, the mesial incisal marginal angle of the teeth often approximates, while the apex of the roots diverge from each other to a great extent.

It will be seen when these three types of frenum are recognized that each one will have to be treated differently, both as regards operative procedure and as regards orthodontic treatment.

OPERATION FOR THE REMOVAL OF THE ABNORMAL LABII FRENUM SUPERIORIS

By Carl O. Engstrom, D.D.S., Sacramento, Cal.

THIS operation for the removal of an abnormal labii frenum was given in substance before the Pacific Coast Orthodontic Society in 1914. The following account of the technic is herein described more exactly, being illustrated by an actual case in practice. In contradistinction to other means this operation exemplifies the principle of complete removal of part of the frenum, following certain definite steps and the consequent definite degree of successful result. While confined to the one class of cases, other characteristics of attachment of the frenum would necessarily alter somewhat the technic of the operation presented and this much is left to the judgment of the operator.

Doctor Martin Dewey cites three classes of the abnormal frenum affecting the positions of the upper teeth.* First, that in which the central incisors are equidistant apart throughout their axial length as shown in Fig. 1; second, that in which the central incisors diverge toward the incisal region as shown

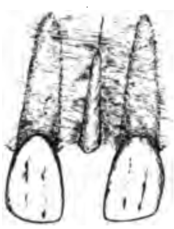

Fig. 1.

Fig. 2.

Fig. 3.

in Fig. 2; and, third, that in which the central incisors diverge in the direction of the apical portion of the roots as shown in Fig. 3.

The abnormal frenum mentioned above, as of Class 1, is usually present and the following description deals principally with that form. A photograph of thé case is shown in Fig. 4. The frenum being more extended does not show the fullness as shown in Fig. 5. It will be noted that the lateral incisors have not erupted and the child is seven and one-half years of age.

An appliance of bands, vertical tubes and pins, and .022 wire was first constructed and adjusted as shown in Fig. 5. By this means pressure was exerted and the central incisors were moved mesially, but not into contact with each other. This was done to promote osteogenetic action. The wire with pins attached was then removed and the following day the operation for the removal of the abnormal frenum was performed.

In Figs. 6 and 7 the incisions are marked. A local anesthetic was used. By means of a cataract knife, incision *a* to *b* was made alongside of the frenum,

*See article by Dr. Martin Dewey, entitled "Three Types of Frenum Labiorum," on page 461 of this issue.

leaving a thin covering of tissue next to the tooth. Beginning this incision, the point of the knife was placed at a point on the process designed to be the inferior extremity of attachment of the frenum following the operation. The cut was made straight down to the bone and extended back to a line tangent to the cingula of the central incisors. Another incision was made similar to *a* - *b* on

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

the other side of the frenum ending at *c*. With the end of the cataract knife the fibers of the frenum were severed from their bony attachment, beginning with incision *c* to *b*. As this was done the frenum was withdrawn from between the teeth by tension, effected by holding the lip. The fibers were found to be attached up as far as the point *a*. The fibers having been severed, and the tension on the frenum being thereby released, the frenum retracted and stood out from the lip but a comparatively short distance. This part of the frenum *d* to *a* was then severed from the lip with a pair of small scissors. No tension was exerted on this part of the frenum in the cutting and as a rule no stitches are necessary. A wire was added to the ends of that shown in Fig. 5 and illustrated in Fig. 8. Adjustment was made to move the central incisors into juxtaposition. The illustration is not quite distinct due to movement of the patient during the photographing. A piece of gauze was doubled and placed under the wire extension as shown in Fig. 9. A one-half per cent solution of chlorazine (Abbott) was flowed over the gauze and incisions, and as the lip was released

Fig. 11.

the gauze was folded preventing a reattachment of the tissues. Instructions were given regarding the cleaning of the gauze and cut surfaces with a one-half per cent solution of chlorazine before and after meals and at bed time, using a water syringe.

Fig. 10 shows wound healed and teeth in proper position with retaining wire. The retaining wire is to be removed when proper support is attained from other teeth.

Fig. 11 is an illustration of the record of treatment. The bands, tubes, wires, and their positions are shown. Under heading "Miscellaneous," the *n* encircled designates notes on the reverse side of the card. On March 27 movement of the teeth bodily and mesially is designated by the letter *m*. It is presumed the other markings will be understood by reference to the description given above. On account of the photographs being taken, more time is recorded than would otherwise be necessary.

This operation commends itself because of its definite procedure and results, its simplicity and the short time in which it may be performed. As a rule the little patient is not cognizant of what is being done.

OUR MORAL RESPONSIBILITY*

By Dr. Charles C. Mann, Seattle, Wash.

In presenting this paper for your consideration it has not been my purpose to elucidate any pet theories but merely to place before you some conclusions of men who have made exhaustive study of the child in his physical and mental development. Children have always been objects of care and solicitude to society and the importance of the laws that govern the growth of the body and mind is obvious to even the most superficial observer.

"Modern biological psychology conceives of a human being," says O'Shea in *Dynamic Factors in Education,* "as most delicately responsive, alike in a mental and in an organic way, to every aspect of his environment. All of his experiences, even to the very least and inconsequential, affect him for better or for worse. Every force that plays upon him be it ever so slight, probably heightens the tide of life or depresses it. Regarded from this standpoint the sole concern of the individual should be to keep in contact with the child those forces which confer greater strength on him, that build up his organism, and avoid those that tend toward destruction."

This being true, we as orthodontists, are assuming a measure of responsibility in our daily association with the children placed under our care, in the mental and moral development as well as the physical and it is meet that we should heed that responsibility.

It has been observed that marked fluctuations occur in growth, especially after the age of six years, the periods being more sharply defined in the male than in the female child. It is said that up to the period of adolescence the child lives more the race life, that at adolescence a strong development of traits ensues and thereafter the child becomes more individual.

At about the time of the beginning of the permanent dentition, the brain is rapidly developing the fibers of connection between its various parts and as a result a marked mental change occurs. The child's interests are greater and more diversified, he plays more games and makes more friends. The senses become more active, observation keener and the development of interest in persons with whom he is associated and the effect of their precepts and example more marked.

Professor Tyler says "He is now observing subsconsciously and without much logical thought. He learns through imitation and suggestion without knowing that he has learned. He acquires at the same time their peculiarities of dialect, of idiom, pronunciation and inflection. He imitates the gait and manners and almost any striking peculiarity of parent or teacher with like results. Not only the habits of speech and action but preferences and aversions, prejudices and superstitions, esthetic and moral standards; even religious tendencies arise, grow and take form as a result of surrounding conditions; he

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., February 18-19, 1918.

knows not how. But these habits of thought, speech and action soon become fixed and unchangeable and fashion his whole life.

"The child's standards of right and wrong are purely personal determined by the results of his actions and therefore dependent upon his surroundings," says Professor Norsworthy of Columbia College and Professor Kirkpatrick says "He is greatly influenced by individuals. Spontaneous imitation leads the child to imitate everything that attracts his notice whether profanity or prayer, caresses or cruelty, rudeness or politeness."

"It is the season for the most momentous and potent influence for good and evil," writes Bourne in "Youth and Life."

So we may go on and on with similar suggestions from these and other noted writers and educators all pointing to the same facts in the life of the developing child. And we have our part in the shaping of these developing characters. Our association with children under treatment extending as it does for a year, two, three and even more, must have its certain effect upon them and it should be our earnest endeavor to exert at all times an influence for good alone.

O'Shea says that teachers and professional people are rather more tense and rigid than most other people. This, if true, is unfortunate as these disorders are contagious. If your nerves are edgewise and you show it in features, voice or bearing, if you are fussy and irritable, those who associate with you are affected and develop your neurotic condition.

Association with nervous hypochondriacs overstimulates other individuals, while on the other hand well poised, well nerved people tend to bring about mental equilibrium.

For one whose work develops overtension the practical remedy is to fill his life with upbuilding ideas and influences. Well selected books that rest and soothe the mind, taking it away from the daily problems, and good music have always been effective in neurotic conditions. A strain of music will change the entire current of thought.

Fatigue has much influence on these neurotic conditions, and is evidenced by tenseness and rigidity. Then a restlessness ensues to relieve the tension, this is nature's way of relieving the strain on the central nervous system. These manifestations in the operator will reflect themselves in the patient and should be avoided. Fatigue is not so much the result of the work of any given effort, this may produce a temporary fatigue which your nerve force overcomes within a short time, but that fatigue to be avoided is the result of too close application over a long period of time without adequate rest and adequate play. Play, gentlemen, is as essential to you now as it was in your youth. To me it seems that, as I grow older, it becomes more necessary to maintaining efficiency. Regular periods of recreation, preferably out of doors, at the sport which suits you best, will result in better health, better nerves and longer, more efficient, life.

Among the phases of environment which exert marked influence upon the human organism are form and color. Experimental science has made some analysis of these influences. It has deduced that beauty exists because the form which the individual regards as beautiful causes agreeable responses

within his organism, and the impression of ugliness results from the opposite set of influences and responses. Color is known to be stimulating, soothing or depressing upon an organism and has a distinct psychological effect.

There are so many angles from which this subject of child development may be studied, so many things to be observed and considered, each child being, as it were, an entirely new problem, that these phases of environment and association with their effects are well worth our earnest thought. Each of us who has the care of the man or woman in the making, should recognize the responsibility devolving upon us, and strive to bring about within ourselves a state of mental equilibrium.

"If you achieve calmness and harmony within your own person, a wave of imitation will spread from you."

DISCUSSION

President Cavanagh.—I think the Society will agree with me we have listened to a paper which has required many hours in its preparation. It deals with matters that may rarely occur to many orthodontists. The "Psychology of the Child" is something that should be incorporated in a progressive school of orthodontia, inasmuch as we are more and more dealing with younger and younger children—at ages when they are most impressionable. Further, we are working under a nervous strain, and we may so arrange our surroundings, our office fixtures, the decorative scheme, etc., as not to be conducive to relaxation, and this reacts not only on ourselves but on those coming into the office. Every person entering a professional or business office is impressed favorably or unfavorably, irritated or rested, by the surroundings. Personally, if I go in a room where the pictures are hung on the wall at an angle or placed in an inappropriate position, I do not rest very comfortably. Those things are affecting us at all times, and if we place ourselves where something irritates us that unconsciously irritates those whom we serve, and more attention should be paid to this matter. In the way of environment, I believe certain malocclusions are produced by a child's surroundings inasmuch as they show similarity in voice, features and various expressions of those whom they admire. I believe certain Class III cases are produced through the imitation of the child,—through the fondness of the child for a grandparent or a parent in whom this type of malocclusion was present.

Dr. B. Frank Gray.—It is safe to assume we are all fond of children. I believe an orthodontist who is not, would manifestly be a "misfit." It has been my pleasure to note in visiting many of my friends in the specialty, there was a most beautiful relation manifest between the doctor and his little patients, a relation quite like that existing between a fond father and his child. That I believe to be the proper attitude. It is not a part that can be merely assumed, for there must be the real love for children in the heart of the orthodontist.

I feel Dr. Mann's paper is an appropriate one indeed, and we will all do well to think more along the lines he has brought to our attention. Not having read the paper, I do not feel competent to adequately discuss it. I am glad we have had the opportunity of listening to it.

Dr. Millberry.—Mr. President and Gentlemen: In listening to Dr. Mann's brief and meaty paper, I have noted his impression that there is so much in the environment of a child's life that has its effect psychologically and physiologically on the child that may materially influence its growth or possibilities in after life. That is the most striking thing in his paper. In recalling a statement made yesterday as to the influence of heredity on certain conditions, and then listening to some of your own individual views in regard to social contacts and family contacts and their influence, I wonder, in listening to Dr. Mann, how far environment will go toward bringing about or correcting conditions that are of paramount interest to the growing child. His resume typifies a very intensive reading in child psychology particularly, and the influence of the surroundings and environment on children. We have each one of us his contacts. For instance the doctor's mention of color. I think the American flag gives an expression which may be subconscious, but there is a certain impulse conveyed to the brain as a result of the color sense, through the eye.

And how much more important that can be made if everyone were to study the matter of color influence on the children, and the effect colors give to children. That is most manifest in dress.

Most people enter a dental office with a sense of fear. If that can be obviated by an arrangement of office equipment, and all the other conditions which influence the welfare of the growth of the child can have attention, how helpful it would be. I am conscious that some of you resort to certain forms of entertainment for the children which overcomes tension and fear. Those influences are important.

As I listened to Dr. Mann's address with regard to orthodontia, I wondered how much more far-reaching this might be in the problem of dental hygiene. Would it not be a worth while thing that child psychology might be taught our dental hygienists in the courses given in that work? Especially it would seem important to those women who expect to become children specialists. It is one of the interesting possibilities of the future.

All these things brought out in your papers today,—these professional contacts, have given me a greater inspiration to go on with our work in the field of dental education, in the hope of leaving no field untouched that is important to the child's welfare.

Dr. Suggett.—I would like to have had opportunity of looking over a copy of Dr. Mann's paper. It contains many points of keen interest. As to environment, I believe it has as large an effect over children as over adults, and I think we are pretty well convinced we must look to environment in what we are doing, not only as children, but as men, states and nations. We consider it now as never before. It has occurred to me, as to our patients, that the nearer we treat the child as a grown person the better. We should not come down to the child, but treat him on a level with ourselves. If we talk "over the head" of a child, we often find they come up to it. Dr. Ottolengui spoke of taking the impression of a boy of six or seven years of age, and the little fellow said,—"Did you have to do this too when you were as little a boy as I am?" Dr. Ottolengui said, "Surely, but you are a big boy, and that settles it." So I try to cultivate the habit of speaking to the children as I would to their mother, sister or anyone coming with them.

I suppose one of the principal things is you really have to love children, and you can not fake it. As illustrating the notions of children, I may refer to a little girl whose father was most fond of her, but did not seem to appreciate how to talk to her nor how to entertain her. At the park, where we chanced to meet one time, we were going over to look at the bears. She said, "I wish you were my father and my father was my grandfather!" The father said, "That is the limit, isn't it!" He said he did not understand children and did not know what to say to them. He had no sympathy nor understanding of children.

In dealing with children, we must not force them. Absolute confidence is necessary.

Dr. Mann.—This subject has been one of great interest and importance to me for a long time. In the practice of dentistry, which I was engaged in for a number of years, I always adopted the plan, probably per force of habit, of maintaining a happy disposition about my affairs. Singing has always been to me a great pleasure, and in my work at the chair as a dentist, I always sang. I have continued the habit since coming into orthodontia. The influence of certain environmental conditions, of color, form, etc., has been brought to my notice in some ways which I did not quite understand. Recently I have had under my care a student of education at the University of Washington, an extreme socialist, and a man who has made an exhaustive study of developmental and environmental features of child life, and in conversation with him it occurred to me this subject has never been given (so far as I know) any consideration in the profession of dentistry, nor in the specialty of orthodontia in the manner of a paper, and I thought perhaps it would not bore you gentlemen too much if I brought it to your attention.

My office has a view of the entire Puget Sound. The sunsets are very beautiful from the windows. I doubt if you can go anywhere and find more beautiful pictures from day to day than from the windows of my operating room. It gives the children pleasure to observe these pictures; they comment on them and are pleased with them. The movement of the vessels in the Sound,—the manufacturing districts where the great ships are built and launched every day now, is always of great interest to the children. To me, a child who is under my care is as if he were my child. I do not agree with Dr. Suggett that a child should be brought up to your plane. You must study what the child likes and dislikes, his susceptibility under certain conditions, and if you do so you will find he will meet you as near your plane as possible, and your mutual understanding will bring about a much easier situation.

I have children who have been with me some years, and some only a short time,

and I want to tell you this, gentlemen, that I have more friends among the little folks that I really care for than I have among the older people. I can depend upon the word of those children just as implicitly as I can depend on the word of my own boy, and so it has been a great pleasure to me to take up this subject as a matter of thought and consideration. I have studied it carefully, and have found the cooperation afforded me by my patients has been a wonderful thing.

If a child comes to me with an unclean mouth, the first thing he does is to apologize for the condition of his mouth, and the children will do so in ninety-nine cases out of a hundred. There is little trouble, after once having instructed the patient as to prophylaxis, to get cooperation.

I think the educational feature, as Dr. Millberry has brought it to your attention, is a wonderful thing, and I think the incorporation of some such idea in the educational institutions will give the young men going out into the profession a better understanding as to these considerations than they can obtain in any other way. Too many enter the profession of dentistry with the idea their dignity should be the first consideration and that it should not be overstepped by anybody. It is beneficial when properly applied, and disastrous when improperly applied. It is easy enough if you have yourself well in hand,—well poised, with flexible minds, to be dignified in all cases requiring dignity, and otherwise it may not be.

I think all of you gentlemen will agree with me after you have gone back to your homes and taken up your work with the children, that a consideration of each child will be of the utmost importance to you in your work.

WHY THE MALOCCLUSION SHOULD BE CORRECTED DURING THE ERUPTIVE PERIOD OF THE PERMANENT TEETH*

By J. W. Rawlings, D.D.S., Tacoma, Wash.

I WISH to make the assertion at the outset of my paper, that the correction of malocclusion should be made during the eruptive period of the teeth. What I mean by the eruptive period of the teeth, is the period between the eruption of the first permanent molar, usually about the fifth to the sixth year, and the eruption of the second permanent molar, usually about the twelfth to the fourteenth years.

It is during this period we obtain our best results, both in the occlusion of the teeth and in the facial lines. However, the orthodontist must accept his patients as they come to him, and this in a measure accounts for the various results obtained. The ideal time in life to commence corrective measures is about the eighth year in life, and if our cases could be selective this is the time we would most desire them. Dr. Lischer has very aptly termed the age from eight to twelve as the "Golden Age" of orthodontia, for the beginning of treatment.

The eruptive period is the critical age for the child for it is the period that the dental arches and adjacent parts either develop in a normal or abnormal degree. It must be understood that malocclusion is progressive in its development; i. e., when one tooth gets out of alignment in the arch, the intimate relationship, dependence and interdependence of one tooth to another, is destroyed,

*Read before the King County Dental Society, Seattle, Wash., April 2, 1918.

and the arch as a whole continues to develop in an abnormal manner up to the time of the eruption of the second permanent molar. There is also an intimate relationship between the normal development of the arches and the jaws; the bony and soft adjacent tissues of the face. This is markedly noticeable in the facial lines. We quickly observe in looking at the features of the child whether there is harmony or inharmony in its development.

The inharmony almost invariably has its beginning from the maldevelopment and irregularities of the teeth. I have given some reasons for the early correction of irregularities of the teeth and now I wish to give you a few reasons why it is advisable to commence the correction of irregularities during the eruptive period.

1. At this time in life the alveolar process is not very dense, and the teeth respond more readily to pressure.

2. The alveolar process not being dense at this age, permits using more delicate appliances which give that easy pressure which experience has shown stimulates cell activity, and the success of orthodontia is fundamentally due to cell activity, for it is through this force that we are permitted to move and retain the teeth.

3. After the crown of the tooth has shown through the gum tissue it is easier to direct it to its normal position through delicate pressure than it is to permit it to take its irregular position and then commence its movement to its normal position.

4. Teeth directed to their normal position during the eruptive process are much more easily retained than those taking irregular positions and then moved to the normal position.

The rationale of this is that the eruption of the tooth consists in the forcing or the elongation of the teeth through the gum and the development of the alveolar process and peridental membrane around it for its retention.

By directing the tooth to its normal position during its slow progress of eruption through the gums and bone we are taking advantage of nature's method of retention.

I desire, if I may, to firmly impress this upon the general practitioner, for I believe the great problem in orthodontia is not in the movement of the teeth, but in their retention. And anything which makes this easier, certainly adds to the more permanent success of correction.

5. There are certain types of irregularities; i. e., the protruding types, Class II—Division I—and Class III, (Angle's classification) that greatly mar the facial balance. There are various degrees of these types and some of them can be safely termed facial deformities. It is more the correction of the features in many of these cases that is desired by both patient and parent, than the correction of the teeth. And if operative measures have not been started early it is impossible to get ideal results. For instance, in a typical Class II—Division I—case, you will have an underdeveloped upper lip and an overdeveloped lower lip. If the lips are permitted to develop in this way, operative measures of the teeth can not possibly change this development of the lips and it will continue to mar the features throughout life. However, if the orthodontist can commence corrective measures early in life before the abnormal develop-

ment of the lips has taken place, with the removal of the adenoids and the correction of the teeth, you will produce a condition whereby the child can breathe normally, and the lips will develop normally, and you will produce a harmony and balance of features which is so satisfactory to both patient and operator.

I have attempted to tell you when corrective measures should be resorted to, and why; and I trust I have made that plain to you; and now I would like to unfix, as it were, the idea which seems to be so firmly fixed in the minds of so many general practitioners, that the time to commence orthodontia treatments is after all the permanent teeth have erupted. Dr. Brady paraphrases this advice to letting the teeth develop in the irregularity to as complicated a condition as they can possibly get, then start in to correct them, instead of catching an individual tooth, which is so often the beginning of the irregularity; and correcting it thereby bring about normal condition, and permitting the arch to develop under these conditions. Every orthodontist is continually annoyed by the parent remarking that the family dentist had examined the mouth and had advised the postponement of operative procedure until all the permanent teeth are erupted.

It is beyond my comprehension how this prevailing idea has become so fixed for I can not find any of the standard textbooks on orthodontia advocating any such procedure. So it is the duty of the general practitioner as well as the orthodontist to advise and educate the public that to obtain the best results in the correction of the teeth, and facial lines, the corrective measures should be administered during the eruptive period.

The general rule should be, the younger the patient the easier and more sure the result.

THE HISTORY OF ORTHODONTIA

(*Continued from page 430.*)

By Bernhard Wolf Weinberger, D.D.S., New York City

THOMAS BRIAN GUNNING, before the Seventh International Medical Congress, 1881, (Vol. iii, page 548, proceedings), presented the following paper: *"Causes of Irregularities of Position of the Teeth,"* under which he said:

"The most trusted teachers and writers upon irregularities of the position of teeth ignore the facts of Nature, and teach others to work, not only outside of, but in opposition to, her processes.

"At the seventh week of foetal life the germs of the teeth begin to start from the mucous membrane, which lies between folds somewhat firmer than itself; and by the thirteenth week the papillæ of all the deciduous teeth are enclosed in open follicles. At the fifth month, the germs of the ten anterior and of the first molar teeth of the permanent set start; and as the deciduous teeth with the sacs of the ten permanent ones grow, and take up more space, the permanent molar is forced into the tuberosity of the upper jaw, or into the coronoid process of the lower. They occupy these positions until the eighth or ninth month; during these two months, the basilar portion of the lower jaw, which supports the alveolar process and teeth, and also gives attachment to so many muscles, is rapidly developed; yet at birth it is comparatively incomplete.

"In nursing, the upper jaw is supplemented by the lip, the nipple being held against the roof of the mouth by the stronger and more active lip, assisted by the less-developed jaw. This keeps the lower jaw back, and the upper jaw projecting, in accordance with the earlier development of its teeth in foetal life. In general, the central incisors of the lower jaw appear first; but when those of the upper come, they are soon joined by their lateral neighbors, the lower lateral incisors emerging later from the jaw, which is still without bony union at its symphysis. Thus, the lower teeth are kept back inside the upper. The lower jaw is more easily observed than the upper; it is therefore, referred to in preference.

"The deciduous set of teeth which begin to appear about six months after birth, are by three years of age arranged in the mouth. At six years the lower jaw is seen to be much deeper and larger in every way, as it holds the temporary set of teeth and also the permanent, so far as developed.

"The jaw generally lengthens until three large molars have come through on each side behind the semicircle which held the deciduous set. The third molars come down like the second and first molars into the dental range, the horizontal portions of the jaw growing an inch or more in front of the ascending ramus in the lower jaw, and an equal length in the upper jaw.

"It is apparent that from the start the vital force is specially exerted to perfect the teeth, and form the jaws for their protection and arrangement in

the mouth. The alveolar process develops with the teeth, and the basilar part of the lower jaw, which grows rapidly just before birth, continues to enlarge in proportion to the development of the teeth; this is shown clearly in its growth to admit the permanent molars.

"Now all this change of the jaw from before birth until adult life is in connection with the development and arrangement of the teeth; and enough has been shown to prove that the growth of the jaws is generally controlled by the development of the teeth."

Gunning then showed that the size and the shape of the jaws may cause irregularities of position of the teeth: (1) Diseases of the teeth may cause irregularity, when, except for it, all would be normal. (2) Premature loss of temporary teeth more than undue retention of them, causes irregularities. (3) Disease of one or more of the temporary or permanent teeth, or loss of either may deform the lower jaw and also displace it. (4) Mistaken views in respect to the treatment.

"In cases of projection of the lower jaw, caused by muscular action drawing the condyles toward the eminentiæ articulares, a plate which projects out from under the upper incisors down in front of the lower, will gradually press the jaw back, and, at the same time, it may be used to correct the positions of the teeth which caused the jaw to come forward. Or, if required, a plate on the lower teeth will throw the jaw back.

"A projecting jaw, which is well seated in the glenoid cavities, can not be pressed back by any apparatus in the mouth, nor by any outside around the head and jaw, whether as pictured in the books or otherwise. If the condyles were pressed back from their natural position, the ears would be closed.

"Except for the relation between the teeth and jaws, and for the changes which are usual to them in the earlier years of life, the most intelligent treatment could be of little avail in preventing or in remedying malformation.

"The fact that when the teeth are lost the jaws are still able to act in functions other than mastication is no justification of the misleading statement that the teeth and jaws are independent of each other.

"If the teeth, as a whole, are too large for the jaw, they should be kept in to encourage the growth of the jaw, as long as this can be promoted, and then such of them extracted as can be best spared to make room for the others. If a jaw is too large prospectively, remove the necessity for its growth, whether in the least important teeth, or in their position, and especially guard against habits which tend to this deformity.

"If irregularity be treated by appliances, they should act naturally; those just prescribed press the teeth either through their own growth, or similarly; when the jaws close, they give the shock usual in natural movements, but upon the intervening appliance. Thus, if the teeth are moved, they are never lifted from their sockets. The teeth, as a whole, support each other, or are affected naturally, and are not moved unnecessarily in other functions. This is especially so with these regulating plates, they having gold hooks imbedded in them, and being used without anything more elastic than hard wood, which deprives each tooth by direct pressure; in this way the apex of its root is carried out with its crown, especially in the lower incisors and the upper laterals, whose thin

roots move readily in the alveolar process, when their crowns are held back by the adjoining teeth, or their cutting edges restrained by gold hooks."

Here we observe Gunning noticed as early as 1881 the bodily movement of teeth; "the apex of its root is carried out with its crown."

J. Oakley Coles before the same Congress spoke *On the Origin and Treatment of Certain Forms of Irregularities of the Teeth.* He referred to his classification of deformities of the upper jaw, already described, as well as a consideration of the influence of the antrum in regard to certain irregularities of the teeth, and was of the opinion that an irregular growth of the external wall of the antrum was a cause of "hypognathism." There was a relation between this the sphenoid, premaxillary bones of the antrum, in reference to dental and maxillary irregularities of form and arrangement. He then considered certain points in the mode of treatment:

"(1) If expansion is tried it should be expansion of the jaw with the teeth in situ in the first instance, and regulation of the teeth individually as a subsequent operation, rather than expansion of the dental arch by pressure applied to the teeth and their alveoli. (2) And next the desirability of extracting the teeth that are out of position, and then restoring the contour of the arch by expansion. This treatment, of course, applying only to the more severe cases."

Joseph Iszlai (*Proceedings of the Seventh International Medical Congress,* page 555) read a paper, *"Illustrating Sketches to Carabelli's 'Mordex Prorus' and its Relation to 'Prognathia Ethnologica' and Meyer's 'Crania Progenæa.'"*

Exact determination of objects and their nomenclature is important. He attempted to prove by a critical survey of Carabelli's work that the different types of closure of the anterior teeth regulated this, and Carabelli's lack of exact determination interfered with his classification.

He proposed a new nomenclature according to the various ways of "biting" as well as to the anomalies of the position of the teeth. The description of Wedl, Baume, Mühlreiter, Carabelli, Magitot and other authors lacked clearness and understanding.

J. W. Smith, before the Harvard Odontological Society, (*Cosmos,* 1881, page 224) spoke *On Relations of the Teeth and Surrounding Tissues in the Correction of Irregularities,* as follows:

"Since the difficulty of correcting dental irregularities increases with age, as soon as it becomes evident that a permanent deformity exists, treatment should be commenced without unnecessary delay. This is appreciated by the dental profession, but, from various causes, many cases are neglected until at or beyond maturity before advice is sought. When thus deferred, the correction of the irregularity is often difficult, and the results of treatment are frequently uncertain. What I have to offer with reference to lessening this uncertainty is the result of some study; limited experience has seemed to confirm my conclusions.

"We have no definite knowledge of the chemico-vital processes involved in the solution of bone under any circumstances. As manifested in correcting irregularities, the process seems to me quite analogous to the absorption of bone during the formation of callus in the healing of bone fractures. Dr. Theodor Billroth suggests that in this process there may be developed lactic acid, which

changes the carbonate and phosphate of lime into soluble lactate of lime, which is taken up and removed by the vessels. But this is only hypothesis.

"By means of the appliance shown in Figs. 1 and 2, the left superior first bicuspid, cuspid, and lateral and central incisors were moved to the left sufficient to almost entirely take up the space left by the extracted bicuspid, and enough to make room for the overlapping central incisor. On account of its

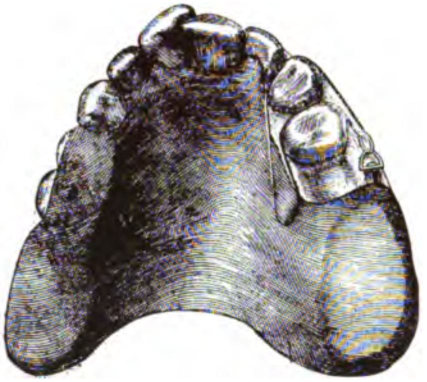

Fig. 1.

Fig. 2.

Figs. 1 and 2.—J. W. Smith's appliances for the correction of irregularities of the teeth. (1881.)

Fig. 3.—Key used to turn screw as employed by J. W. Smith. (1881.)

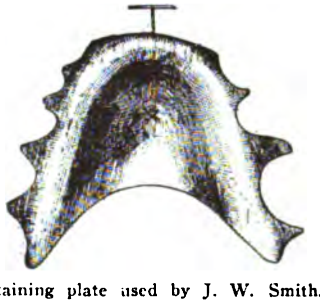

Fig. 4.—Retaining plate used by J. W. Smith. (1881.)

strength, Japanese grass-line was used instead of silk or linen in connection with the plate and screw. This appliance was entirely under the control of the patient. It was removed once a day for cleansing, and the screw tightened once in twelve hours. Fig. 3 illustrates the key used to turn the screw. The prominent central and the depressed lateral incisor were easily moved by simple means.

"A retained plate (Fig. 4) holding in position the right central incisor, is all that is now required."

(To be continued.)

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

Under the Editorial Supervision of
James David McCoy, D.D.S., Los Angeles—Robert H. Ivy, M.D., D.D.S., Milwaukee
B. Frank Gray, D.D.S., San Francisco

It is the object of this department to publish each month original articles on dental and oral radiography. The editors earnestly request the cooperation of the profession and will gladly consider for publication papers on this subject of interest to the dental profession. Articles with illustrations especially solicited.

THE USES OF THE X-RAY IN MODERN DENTISTRY AND MEDICINE

By Julian A. Zabrocki, Ph.G., M.D., D.D.S., Chicago, Ill.

THE x-ray was discovered by William Conrad Roentgen in the year 1895. Several years later the dental profession first became aware of the wonderful diagnostic aid, and the almost unlimited use of the x-ray in the practice of dentistry.

The past eight years mark the greatest advance that dentistry has ever known in any like period. It represents a period of better and more scientific dentistry. The hour has come, when through the aid of the x-ray, we can see the results of our work and efforts. We can judge the value and merits of our endeavors; also, we can view our prospective field of operation. Never in the history of the world has the dental profession progressed as rapidly as it has in the past few years.

Dentistry as a profession is now in such an advanced position, that the Chief Executive of these United States of America—our most beloved President Woodrow Wilson, has officially recognized the dental profession as a branch of medicine, and rightly and justly put us on par with our medical brothers, with the same rank, privileges and retirement in the army and navy.

The dental profession can not stop and wait for the laggards, it is moving along with the impetus it has gathered, but in moving along, it offers educational opportunities in every direction to all who will but seek them. Our society and club meetings are entitled to be considered as postgraduate courses. Our dental and medical journals teem with information from the pens of the best men in the profession. There is no excuse for any dentist to lay blame to anyone but himself if he is not familiar with the leading thoughts of the day.

The time has come for the maintenance of health, happiness and efficiency of the present aggressive and progressive generation of men and women. The hour has arrived when the dental profession can realize and fulfil the prophecy of the famous surgeon, Doctor Mayo, of Rochester, Minnesota, who recently said that the next great step in preventive medicine would come from the dental profession.

I honestly and sincerely believe that the dental x-ray as a diagnostic aid and adjunct to dental and medical practice will do more than any other single medium to enable the fulfillment of this prophecy.

Fig. 1.—Opacity due to empyema of left maxillary sinus.

Fig. 2.—Upper right lateral incisor shows root filling passing through apex into large periapical area of chronic rarefying osteitis with ragged edges indicating a suppurative process. Pulp vital in central incisor, the apex of which extends to edge of area of disease.

Fig. 3.—Lower right canine, caries of distal surface of crown. First and second premolars crowned, partial root fillings, periapical chronic rarefying osteitis and granuloma.

There is no subject in the whole field of radiography, that is so full of interest to the various specialties of medicine and surgery as that concerning the use of x-ray in dental and medical practice. The dental radiograph offers its utmost service as a means of detecting and locating focal infections with pathological conditions of the teeth, jaws and adjacent tissues of the oral cavity, which are established as etiological factors of constitutional conditions or secondary lesions, localized almost anywhere in the entire body.

These secondary effects or lesions include gastrointestinal disturbances, appendicitis, pains in the head or neck, neuritis, myositis, arthritis, inflammatory lesions of the eye, endocarditis (heart lesions) rheumatism, abnormal mental conditions, such as melancholia, irritability, insomnia, neurasthenia and temporary insanity. In the presence of any one or more of these conditions, a complete x-ray examination of all the roots and teeth is indicated, before dental procedures are attempted.

The dental x-ray is not a fad as some of the old timers are inclined to believe, but an absolute essential, and necessity for correct diagnosis. As a matter of fact, many of the best diagnosticians in medicine and dentistry insist upon complete, full mouth, x-ray examinations of every patient presenting himself for treatment.

Fig. 4.—Horizontal impaction of lower left third molar.

You can see from the diversity of the diseases I have mentioned, that practically all the branches of medicine and surgery are affected, and they must accordingly all be interested in dental radiography.

The need of absolute cooperation of all the specialties of medicine and surgery can not be overestimated. In the first place, the dental conditions that cause the more serious secondary disturbances are not always associated with

the important local subjective symptoms of pain; if they were, the patient would immediately seek the attention of the dentist, and treatment would be instituted before other harm resulted.

Many of these painless dental lesions are discovered in the course of routine radiographic examinations made at the instance of the physician, internist,

Fig. 5.—Large area of bone destruction on right side of mandible due to cyst formation probably arising in connection with irritation following periapical infection about the second premolar and first molar. Observe sharp outline of cavity.

Fig. 6.—Periapical bone destruction connected with lower left second molar. Patient, fourteen years of age, had lost first molar on that side some years previously. For several months had had a sinus discharging through the skin just below the lower border of the mandible. The second molar appeared normal except for a large filling. On extraction of this tooth a dead infected pulp was found.

The crowns of the unerupted upper and lower third molars with undeveloped roots are shown. Upper third molar of opposite side is seen as a light area above the premolar region.

neurologist, orthopedist, ophthalmologist or other specialists to whom the patient appealed for relief, because of the symptoms arising from the secondary lesions.

The interpretation of the x-ray findings, which if based upon a familiarity with the problem of the dentists' need, will often prevent ill feeling on the part of the patient, or too radical recommendations for treatment on the part of the physician or other specialists, or on the other hand, guided by broad experience in the observation of similar cases from both the medical and dental practice, will suggest the necessity of efficient yet conservative dental treatment.

Because of frequent experience with all sorts of cases, and because of unequaled opportunities for discovering unsuspected underlying etiologic factors, the roentgenologist may well be considered as a diagnostic clearing house—suggesting to which specialist a case should be referred for treatment and encour-

Fig. 7.—Fracture of left side of mandible near canine tooth, with very few teeth present. This is said to be the commonest site for fracture to occur.

aging co-operation between those specialists and incidentally rendering the patient the best service possible.

By employing the radiograph, nearly all guess work is eliminated. There are possibly a few instances, in which the x-ray may not be regarded as infallible evidence, but in the great majority of cases the evidence which it produces is an absolute reflection of existing condition. Periapical abscesses, cysts, osteomyelitis, necrosis, sequestra, lost roots, broken broaches in root canals, root canal work, check up on root canals after canals have been filled, fragments of instruments lost in the tissues, preoperative, orthodontic treatment and check up, impacted third molars and cuspids are definitely located through the aid of the x-ray, when all other diagnostic means have failed. In pyorrheal alveolar absorption again the dentist is enabled to definitely determine which teeth should be extracted and which retained as abutments for bridges or partial dentures.

In antral infection a definite diagnosis is reached. Again the x-ray positively shows whether the antrum is infected by diseased tooth roots penetrating

the antral floor, or whether the infective microorganism gained entrance through the nasal route. In fractures and dislocations, the condition is definitely revealed by the x-ray.

With the knowledge in our possession or at hand, for the dental surgeon, who will but avail himself of the opportunity, is there any excuse for the up-to-date dentist in depriving his patients of information which may be vital to their health and happiness? Is a dentist justified, when he makes a definite statement, that a tooth, which has been the seat of a chronic infection for years, is absolutely out of consideration as a possible source of secondary disease conditions? If this statement is made without thorough investigation the dentist imparts an incorrect diagnosis to his patient, who places implicit confidence in him, and as a result the patient's health has been undermined and impaired.

Fig. 8.—Fracture of left side of mandible just in front of second molar. First molar missing. The line of fracture in this region is nearly always oblique, running from above downward and backward.

In conclusion, let me sound a keynote of warning to the general practitioner—as a result of information gained through the use of the x-ray—

Save every vital pulp possible.

Don't devitalize teeth promiscuously.

Don't treat abscessed teeth—extract them, and curette diseased areas thoroughly.

Don't insert a lot of fixed bridge work on devitalized abutments.

Insert more removable bridge work, and partial dentures on vital teeth, you will spare your patient from focal infection and an endless chain of complicated secondary lesions.

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EDITORIALS

The Ethics of Orthodontic Patients

A GREAT many articles have been written upon professional ethics both as related to the medical and the dental profession, and several papers have appeared which have dealt directly with the question of ethics as involved in the practice of orthodontia. Several articles have been published on the relation which exists between the specialist and the general practitioner in regard to the referring of orthodontic cases and their treatment. The majority of these articles have either been written by men engaged in the practice of dentistry or men engaged in the practice of orthodontia and all of them seem to have been written entirely from the standpoint of the profession.

None of the articles, that we have read have paid any attention to the question of ethics from the standpoint of the patient. Therefore, some of

the things which we will say in this editorial may not exactly agree with the principles that have been laid down by some of the former writers because we are looking at the question from the standpoint of the patient as well as from the standpoint of the professional man. It must be remembered that all questions of ethics and questions of morality are simply questions of education. In other words, things that may be supposed to be right and proper at one time would not be considered the proper thing at another. We find the idea of right and wrong changes with the ideals of the people.

Certain practices are tolerated in one community or country which would not be considered right in another country. Still, who has authority to say that one is right and the other wrong? We only cite the fact that a few years ago in America slavery was considered right and proper and consequently was ethical. As a result of changed conditions the question as to whether slavery was right or wrong, whether it was ethical and moral, finally became a question over which the American people went to war before it was satisfactorily decided.

A few years ago any one who advocated the ownership of public utilities by the government was conceded to be more or less of a crank, a socialist, and a dreamer. But the passing of a few years has developed that the tendency of the majority of the people is for the government ownership of public utilities and a great many believe that the resources of a nation should belong to the people at large and not to a few individuals.

These are all changes in the ethics of the people which have been brought about by special education. Therefore, it would not be strange if in the practice of a profession conditions would develop which, from an ethical standpoint, would differ from the old rule of ethics which was held in former years or held by a few men. In the practice of orthodontics as related to the patient, there seem to be a certain number of conditions developing which make necessary certain changes in regard to ethics that differ from the opinion which is held by a great many writers. The rules of ethics as laid down by the medical and dental professions in the majority of cases have been formed for the benefit of the profession, and the patient, to a certain extent, has become a secondary matter. Of course, the welfare of the patient has been taken care of in a professional way. His care has been provided for by the profession at large, but he has not been consulted in regard to how or why he should be taken care of.

We find the practice of orthodontics somewhat different from the practice of any other phase of medicine or dentistry. In the practice of surgery, a surgeon performs an operation for the patient and the patient either dies or gets well in a comparatively short length of time. A physician is treating an individual for pneumonia or typhoid fever; the patient either recovers or succumbs also in a comparatively short period of time. Orthodontic cases extend over a long period of time. The same is true in the majority of dental operations—the dentist finishes the work and dismisses the patient. A patient who has had one surgical operation is not necsessarily obliged or compelled to go to the same surgeon for a second operation. The physicians do not own their patients after they have succeeded in curing or treating them in an attack

of typhoid fever, and if the patient has another illness he has the liberty to call in another practitioner to treat him for that particular illness. After a dentist has completed a piece of work the patient does not necessarily belong to that dentist but may seek another man for the next dental operation. Of course, it necessarily follows, in the case of the surgeon, the physician, or the dentist that if the results are satisfactory, the patients will return to those practitioners. However, we find that in neither surgery, medicine, nor dentistry does the practitioner have an ownership upon the patient nor is the patient compelled to return to him time after time and year after year unless truly satisfied with his work and with the personality of the operator.

In the practice of orthodontics conditions are decidedly different than they are in many other kinds of work. The treatment of a case of malocclusion necessarily covers a number of months and a large number of cases extend over a period of years. It may develop that a patient will begin an orthodontic treatment with one orthodontist and before the case is completed, for some reason or another, may decide that he would prefer to have the case completed by another man.

The reasons for the patient deciding to have a second man complete the orthodontic work may be many. It may be a question of personality in which the patient and the operator do not get along. It may also develop that the plan of treatment which the first man had employed was not satisfactory to the patient's parents and they desire to go to some one else who, they have found out by investigation, pursues a different plan of treatment and uses different methods. For example, one operator may be treating the case with a fixed appliance and the patient may decide that he prefers to have the case completed with a removable appliance. Under those conditions he will necessarily seek a man who uses removable appliances, and the question develops as to what right the patient has who begins the treatment with one man and goes to another. From the standpoint of the patient he has an absolute right to change orthodontists the same as he has a right to change dentists or family physicians. We are aware of the fact that this will not be in accord with a large number of men practicing orthodontia, who seem to think that when they begin the treatment of a case, regardless of what conditions develop between them and the patient, regardless of whether they are satisfying the patient with the results or methods used, the patient must continue under their treatment until the case is finished.

This is probably the professional attitude that has been held for a number of years, but nevertheless we do not believe it is absolutely a fair attitude to the patient, and do not believe that a man should practice orthodontics from that standpoint. If we recognize the possibility or the fact that the patient should be allowed the privilege of changing orthodontists provided the first man does not satisfy him for any reason, we immediately are confronted with the fact that it may be difficult to collect a fee which will properly compensate the first man for the work which he has done. This question of collecting a fee then involves the general plan of naming the fee or making financial arrangements with the patient in the beginning.

If patients are to be allowed the privilege of changing orthodontists dur-

ing treatment, this necessitates arranging the fee to provide a proper compensation for services rendered any time the patient wishes to change. Therefore the only fair way to the patient and to the operator would be to have fees so fixed as to make a definite charge for each operation or a definite charge for the amount of work done each month. For example, if a patient were to pay an orthodontist for the making and adjusting of an appliance, and then either pay a definite sum for each treatment or for each month's treatment, it can be readily seen that the patient who would desire to quit the first orthodontist at the end of the year or at the end of any month, could do so and there would be no misunderstanding in regard to the fee earned either by the patient or the orthodontist.

Recognizing the right of orthodontic patients to leave one orthodontist who is not rendering them satisfactory services, or one who is at least not satisfying them, regardless of what the condition may be, and going to another man, the relation of the second man to the first is one which has to be considered. For example, if a patient who is undergoing orthodontic treatment becomes dissatisfied with the first man and goes to the second man, what attitude should the second man hold toward that patient and what advice should he give?

We are aware of the fact that a great many men will say that no one has any right to take such a patient without consulting the first man and to use every means within his power to send the patient back to the first orthodontist. We are aware that such is the ethical side that is advocated by the rules of ethics and also aware from practical experience it is not the plan that is generally followed either in the dental or the medical profession.

Taking a similar case in the medical profession where a patient has been undergoing treatment for disease of the eye or throat trouble from one medical practitioner and decides to quit that man and go to another one. When the patient has left the first man and has decided he will not return, the second man can not succeed as a rule in making the patient go to the first man, and will only cause him to hunt for another practitioner. Again in the case of the dental profession, a patient may have been undergoing treatment for pyorrheal conditions from one dentist and decides to go to the second. He has left the first man for some particular reason which as a rule is none of the second man's business and has come to the second man because he prefers the second man's plan of treatment and prefers to place the case in his hands. If the man believes the first man was performing the proper treatment, we agree he would be performing the first man a service by telling the patient that the plan of treatment was successful and proper and in urging him to continue under the first man.

However, we do not believe that he should insist upon the patient's going back, because there may be personal reasons for which the patient will not return to the first man and the second man will be performing the patient a valuable service if he gives the best treatment possible under the conditions existing. When an orthodontic patient has been undergoing treatment from one man and for some reason decides to leave him and go to a second, shall the second man insist upon that patient returning to the first one or shall he

go ahead and render the best orthodontic service possible under the existing conditions? We realize that it is a very delicate question and one which has to be dealt with very carefully. However, we also know if an orthodontic patient decides to quit an orthodontist for whatever reason, there is no power on earth that will make that case return to the first man. The first man may be giving the proper treatment, may be accomplishing a good result, but something has arisen in the mind of the patient which has made him conclude he is going to some one else. We therefore believe it is time wasted in attempting to send that patient back to the first man for you only assist in sending him to some one else who may be unable to render as good a service as the first orthodontist or as good a service as you could render yourself. Therefore, admitting that the first orthodontist is performing the proper line of treatment, from the ethical standpoint of the patients they have a right to go to a second man if they are not satisfied with the first.

Some would say they have a right to go to the second man provided they have paid this first man for the treatment or service he has rendered them. We will admit that the question of the fee may be one of the things that has resulted in the patient leaving the first man, but we also do not believe that the second orthodontist should become a collecting agent for the first practitioner. The first man should have so made his financial arrangements with the patient that he would be able to collect his fee and collect for his services during treatment; probably had he done this, there would not have developed the misunderstanding which may have been the cause of the patient's seeking another orthodontist.

After considering orthodontic patients who quit a first operator and go to a second because of some misunderstanding when the orthodontic treatment is proper, we have another class of patients who become dissatisfied with the first plan of treatment because unsatisfactory results are being accomplished or because the patients are not pleased with the style of appliance or plan of treatment being pursued. We are forced to admit at the present time that there is such a thing as a proper plan of treatment by an orthodontist as compared with plans of treatment which do not have the sanction of the best men and which may be called improper orthodontics. For some reason or other the patients may have begun treatment with a man who did not possess a high degree of skill and after having the cases treated a number of months, they become aware of the fact that they are not getting the same service that friends of theirs are obtaining from men who are more proficient in the treatment of malocclusions. As a result of this, the patient who is getting poor orthodontic service goes to a man who is capable of rendering a good service. The proficient man sees the appliances are improperly and poorly constructed and the plan of treatment is not suited to the case, and if this plan of treatment is followed the orthodontic result is going to be unsatisfactory.

We are aware that under the rules of ethics one practitioner should protect another which should be done only so long as this protection can be rendered without causing the patient an injustice or without being a detriment to the science of orthodontics. If one man is attempting to treat a case of malocclusion and the treatment outlined in that case is going to be a failure, it seems

to us that any practitioner who would protect such a treatment, with the mistaken idea of protecting a fellow practitioner, is rendering all men engaged in the practice of orthodontics an injury, causing an injury to the patient, and hurting the science of orthodontics, because unsatisfactory results are going to follow from a faulty plan of treatment. We believe, then, it is the duty of a man where dissatisfied patients leave an improficient orthodontist and go to one who is able to accomplish a satisfactory result to take the case, begin the treatment, and show the patient that a satisfactory result can be obtained. We have known of cases that have been under orthodontic treatment for a number of years after which time the teeth were practically as irregular as they were in the beginning. The patients because they have not obtained satisfactory results in two or three years' treatment are at the point of condemning orthodontics as a whole, and it remains for any one who is able to accomplish a result in those cases to take the patients and prove to them that satisfactory orthodontic results can be obtained. We believe that when a man is so unskilled in the practice of orthodontics that he will place an appliance in the patient's mouth that is not suited for that particular case, one which produces actual injury to the patient during the course of treatment, the patient has a right to seek a more competent practitioner, one who will prevent an orthodontic failure and render the patient a service. We believe the patient should receive some consideration and if the patient becomes dissatisfied with the plan of treatment that is known to be an improper plan, it is folly and injustice to the patient and to orthodontics for any one to insist that they shall continue that treatment with the first man even though the code of ethics insists that one practitioner shall protect another.

The first duty of any profession is to humanity and to the public itself and the patient is entitled to some consideration, as well as the science of orthodontics is entitled to respect, for the fact remains that if a mistake is being made and that mistake can be rectified from an orthodontic standpoint it should be rectified by any one given an opportunity to do so.

Another question of ethics as regards the patient, which should receive consideration is found in those instances, where the patient begins treatment with one orthodontist, leaves the city, and the treatment must be continued by some man in another locality. While this question to a certain extent concerns the patient, it also to a greater extent concerns the two orthodontists. We realize that in a large number of instances the transfer of patients from one orthodontist to another, as a result of the patients changing their residence, has not been satisfactory to all concerned. This unsatisfactory condition has resulted because of faulty business arrangements between the two orthodontists, or between the orthodontists and the patient. This is a question which, for the benefit of the patient and orthodontist, should receive more attention than it has in times past. In a great many instances, one man will begin treating a case and after the patient has been under treatment for a period of time, he decides to change his location. The patient is referred to a man in the city to which the patient is moving and the difficulty that arises is generally over the question of a fee for services rendered by the first orthodontist and for service to be rendered by the man to whom the case is referred. This difficulty

over the question of fees which has arisen many times has been the result of several things.

The first man, who began the treatment of the case, may have been so unwise as to state a definite fee for which he would treat the case. He may have made arrangements in regard to the collection of the fee, or a certain sum to be payable in a certain length of time, with the result that most of the fee may have been collected before the patient decided to change locations. As a result of this, the patient goes to another town and desires a second man to complete the work for the remainder of the fee as named by the first operator. In a great many instances the first man was entirely honest in naming the fee and would have completed the case for the sum named. The first man who collected the majority of the fee may believe he has done the major portion of the treatment, but conditions develop which require the case to be watched for a number of months and maybe for years, and there follows a long period of retention during which time the second man has to be responsible for the case. He does much more work on the case than the first man did and the first man gets the larger portion of the fee. There is no question but that a great service has been rendered in the treatment of a malocclusion when the first appliances are adjusted, but the fact does not necessarily follow that the greatest amount of work has been done, or that the man who adjusts the appliance, treats the case a few months is entitled to a larger fee than the man who finishes the case and watches it through the period of retention. We have known of several cases where a decided misunderstanding has arisen between orthodontists over such a condition because the first man named a fee, collected over two-thirds of the fee for adjusting the appliance and treating it for a few weeks, and then expected the second man to finish the case for the remainder of the fee and watch the case during a much longer period of time than the man who began it.

It seems to us that the only logical way to adjust the question of fees in the transfer of patients, so as to be perfectly satisfactory to the patient and to the orthodontist, is for the first man to collect such a fee as he thinks he is entitled. The patient should then be sent to the other orthodontist with the understanding that he will have to make financial arrangements with the second man that will be satisfactory to the second orthodontist. The man who begins the treatment of a case of malocclusion should not attempt to arrange the fee for the second man, because conditions may differ in the two localities, or the man may conduct his practice along different lines and have a different plan for naming fees, and each one should be allowed to make his fee accordingly. If the patients are not satisfied with the financial arrangements which the second man insists upon, they can then seek the services of someone else, as they will not be obligated to the first man, for they have paid him for his services, and have only themselves to satisfy.

Another and unpleasant condition, from an ethical standpoint, which may arise in the transfer of patients is in regard to the manner of appliances and plan of treatment which is to be followed. We have known of several instances where patients have left men practicing in one locality and moved to another and before changing their location, the first man has impressed upon the patients

that the cases could be successfully treated only with a certain style of appliances and they should go to a man who was using only that kind. We believe this is a mistake for any man to be so conceited as to believe his particular style of appliance or any particular style of appliance is the only appliance which should be used or the only one with which a satisfactory result can be accomplished. It is very well to caution the patient in regard to seeking an orthodontist who has recognized ability, but to insist upon that man using a certain style of appliance is carrying the matter entirely beyond the principle of ethics and entirely beyond the welfare of the patient and the profession.

Another thing in regard to the use of a certain style of appliance, when patients transfer from one city to another, may arise in the mind of the second man. For instance, the first man may be using an appliance which the second man has not found satisfactory. It would therefore be foolish for the second man to continue the treatment of the malocclusion with the appliance that the first man had used when the second man could obtain a more satisfactory result in a shorter time by using a different appliance. Because a second man changes the appliance does not necessarily mean that the first man could not have accomplished the result with that appliance, but it simply means the second orthodontist can accomplish the result quicker and more easily with the appliance with which he is familiar than he can by attempting to treat the same case with an appliance he has not found satisfactory.

As an example which covers the facts mentioned we recall a case which was referred to us a few months ago from another city. The patient referred had been informed that the particular appliance which was being used on his teeth was one which was very superior to anything else and the most modern appliance that could be employed. The patient had been instructed in regard to the fact that this style of appliance must be used during the entire treatment. The patient had also been informed in regard to how much he should pay to have the case finished and it happened to be the remaining fee that the orthodontist in the first case had not collected. Upon examining the patient several weeks after leaving the first orthodontist, the regulating appliance was in very bad condition, and being a style of alignment wire, the screw on the alignment wire had been turned so far that it had reached its limit of usefulness. In other words, no one could treat the case any further successfully with that appliance because the limit of usefulness had been passed owing to all of the thread on the alignment wire being utilized. The amount of work necessary to be done on the teeth was entirely out of keeping with the small fee that was supposed to be collected for doing the work. The patient immediately informed us that a certain style of appliance was to be used on the case and the first man had informed him that he should only pay a certain fee for having the case completed. Under those conditions it was practically impossible for us to continue the treatment of the case. The result of this was that the patient went somewhere else. Whether he succeeded in finding a man who was willing to follow his instructions in treating the case, we do not know. However, the difficulty in this case could have been avoided, if the first man had not insisted upon making financial arrangements for the second man and had he not insisted upon choosing the appliance the second man should use on the case.

We believe, therefore, in the transfer of patients from one locality to another, during the period of active treatment the first man should collect a fee for his services, allow the second man the liberty of making financial arrangements suitable for his services, and allow the second man the privilege of using the kind and style of appliance he wishes to choose.

We have another question of ethics from the standpoint of the patient which involves those patients who remain only a short time in the city and in which it is necessary that they see a second orthodontist but one or two times. The question naturally arises what should be the attitude of the orthodontist giving emergency treatment to those cases in regard to the question of fees. We realize that it has been a matter of custom among many orthodontists, particularly where men have been personal friends, to give emergency treatment to a case of that sort without making any professional charge. This plan may be perfectly justifiable when doing a friendly act for the orthodontist, but from the standpoint of the patient, it creates a bad precedent, neither is it fair to the man rendering the emergency service. From an ethical standpoint, there is no reason why a patient who has one treatment with an orthodontist should not pay for that one treatment in the same proportion and rate that other orthodontic patients pay during the process of regular treatment. We believe that when one orthodontist has a patient living in a certain city, and he has that patient call on another orthodontist, the patient should be informed that he will be expected to pay the man such a fee for treatment as he receives from his regular patients for the same service. Such a plan will relieve every one of obligation and the patients will be paying no more than the usual fee which the second orthodontist receives for such services. As a question of ethics in these cases, a man giving emergency treatment should be very careful not to make any remarks in regard to the treatment that was carried on by the first orthodontist which may be misinterpreted by the patient. The second man may necessarily not agree with everything that the first man is doing, but as he will not have an opportunity to finish the case, and as he is only supposed to be rendering a service for the time being, he should render that service, allow that patient to return to the first man in exactly the same state of mind as he was when the second man saw him.

We have mentioned the inadvisability of a dentist or an orthodontist who begins the treatment of a case of malocclusion advising the patient as to what he should pay to have the case completed if the patient moves to another city. A similar condition exists where the patient seeks the advice of an orthodontist in one city but is not able to have the first orthodontist treat the case. The man who examines the case first refers the patient to an orthodontist in the locality in which the patient lives, but in making that reference, he should not insist upon the plan of treatment that the second man shall follow as the only plan that may be correct. It is perfectly feasible for him to advise the patient what should be done or how he would do it and what kind of appliance he would use, but it is not right for him to insist that the second man should follow exactly the same plan of treatment or use the same appliance. If the patient likes the plan outlined by the first man, it is the patient's business of course to find a man who will follow that plan.

In a great many instances the second man may accomplish the same results by using a different appliance and accomplish it more quickly than if he used the appliance as outlined by the first man. It is also unfair for an orthodontist to examine a case and inform the patient that he should pay only a certain fee, because one man has no right to regulate the fee of another. No man should place the value upon the professional services of a second man, and, consequently, he should leave the patients free to choose the orthodontist and pay what they want to pay for professional services without informing them that they should only pay a certain fee and no more.

Another question of ethics from the patient's standpoint is that involved where the patients began treatment with a general practitioner. After the case has been under treatment a while the patient finds out that there are specialists engaged in the treatment of malocclusion and probably compares the results being obtained in his case with those being obtained by specialists. He becomes dissatisfied with the general practitioner and seeks the services of a specialist. Probably from an ethical standpoint, as laid down in the code of ethics by some writers, the specialist should have nothing to do with the case that has been begun by a general practitioner; that is, some of them would have us believe because the general practitioner has begun the treatment of the malocclusion, the patient should be compelled to continue with him regardless of the results that are being obtained. We do not believe that orthodontists should try to influence the patients to leave a general practitioner, but we do believe, that when the patients, because of their own free will, and because of knowledge obtained in various ways, become dissatisfied with the result that is being obtained and all orthodontic knowledge shows that those results are going to be failures, if the orthodontist does not take the case when the patient desires him to and carry it to a satisfactory result, he is not doing the proper thing by the patient or doing the proper thing to advance orthodontics as a science. We realize such a statement is more or less revolutionary in regard to some of the things that have been taught under ethics in times past, but we contend there is such a thing as ethics from the patient's standpoint and the first duty of a specialist in any profession or science is to render a service to the public, showing them the difference between good orthodontics and bad orthodontics.

We therefore believe that when a patient who becomes dissatisfied with results being obtained, consults an orthodontist, the orthodontist is doing the proper thing by giving the patient the service he is entitled to, instead of insisting that he go back to the general practitioner. Any man who would insist upon a patient returning to a general practitioner who is accomplishing an unsatisfactory result would be unfair to himself and unfair to his specialty. We have known of a great many cases treated by men with a small knowledge of orthodontia, who worked on the case a number of years, collected a certain fee, and obtained such a result that after they were through they should not only have returned the original fee to the patient, but should have paid the patient for having allowed them to work on the case. We believe therefore from an ethical standpoint that the patient is entitled to as much consideration as anyone, and should be the first consideration in all orthodontic practices.

Another phase of the subject from the patient's standpoint involves the

right of the patient who has begun orthodontic treatment to go to another practitioner and seek advice in regard to the results that are being accomplished under the present plan of treatment. The patient may have been receiving orthodontic service for a number of months or years and for some reason the question has arisen in his mind whether proper results that should be obtained in the treatment of that case were being obtained. When such a patient presents himself to a second orthodontist, he is entitled to that advice; but, in giving advice, the second orthodontist should first place himself in the position of the first man as well as in the position of the patient. We all realize that if we were having orthodontic service for our own children and believed that that service was not satisfactory, we would probably desire to seek someone whom we believed capable of giving advice upon the subject. The second man should very carefully take into consideration everything, for in a great many instances he does not know the circumstances under which the first man has been compelled to treat the case, and consequently the advice which he gives the patient should be very carefully chosen, and anything he tells the patient should be told in such a manner as to force him to realize that the first man has done everything possible under the circumstances, if such seems to be the truth. However, if conditions should indicate that progress is not being made as rapidly as it should be made, or if the appliance produces an action that is injurious upon the teeth and surrounding tissue, then telling the patient the truth does not become such an easy proposition, and probably all he should be told is that you yourself would not use that plan of treatment. However, if the appliance is doing actual injury and other things indicate that the first man is not able to accomplish a satisfactory result from an orthodontic standpoint, it is proper and right that you should advise the patient that the case could be more hygienically treated by using a different plan than is being employed. We realize that this is a very troublesome question and one that has been given careful consideration, but still it is a question in which the patient is entitled to some consideration, if one is willing to place himself in the patient's position.

We realize that one man has to be very careful in regard to giving advice to a patient because there are a large number of individuals and lawyers, who under the least possible pretense, are willing to file damage suits against the professional man if they can get the least possible grounds. Therefore it would be unwise for any man to actually condemn an operation and condemn the style of appliance that is being used by telling the patient that it is absolutely contraindicated and that the treatment is faulty and wrong. Even though the man believes the appliance would not accomplish the result, he should only say that in his case he would use a different kind of appliance than the one that is being used. We must realize that some men can get a result from one appliance while others can get a result from another. When the patient under orthodontic treatment seeks our advice, we can only give our personal opinion, which amounts to nothing more than stating our opinion against that of the other man and we should in no other way make any statement which may be contributed as a possible ground for damage suits.

We know that the question of ethics from the patient's standpoint is a very

large problem and one which presents a phase in nearly every individual case that we are anxious to get away from, and very few of us have had the moral conviction to approach the question and study things from the standpoint of the patient. That the patient has some rights must be recognized, and the sooner the profession recognizes those rights and are willing to place themselves in the position of the patient, the sooner will the troublesome questions adjust themselves, because nothing will be gained by allowing a condition to exist that is not exactly right to every one concerned.

The President of the American Society of Orthodontists

THIS month we present in our frontispiece the photograph of Oliver W. White, D.D.S., of Detroit, Michigan, who was elected to the presidency of the American Society of Orthodontists at their eighteenth annual meeting held in Chicago, August 1, 2, and 3, 1918.

Doctor White was born in Chatham, Ontario, Canada, on January 4, 1876. He attended the Chatham Collegiate Institute, and matriculated from the Royal College of Pharmacy in 1894. In 1895 he entered upon his studies in the Dental Department of the University of Michigan, and received the degree of Doctor of Dental Surgery in 1898 and Doctor of Dental Science in 1899. In 1903 he attended the Angle School of Orthodontia. Being president of dental societies is no new honor to Doctor White, for at various times he has been president of the First District Dental Society of Detroit, the Michigan State Dental Society, and the Detroit Dental Club. He is an honorary member of the Toledo Medical Society and a member of the Wayne County Medical Society.

SAINT APPOLONIA

(From painting by Carlo Dolci, in Galleria Corsini, Rome, Italy)

Saint Appolonia, Patron Saint of Dentistry, was born in Alexandria, and lived during the third century. In the year 300 A.D. she was canonized by the Church of Rome, and the ninth of February has been observed by the Church of Rome in her commemoration.

"As a Christian she was tortured by having her teeth broken and extracted, after which she was burnt at the stake. When under torture she is said to have prayed that those who remembered the day of her martyrdom, and in their prayers realized the pain she suffered, might never have toothache or headache."

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ORIGINAL ARTICLES

SOME OBSERVATIONS OF THE TREATMENT OF CLEFT PALATE*

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HARELIP is a deformity of the upper lip of congenital origin, varying in different individuals in size and location. The nomenclature used in the description of this defect is very misleading since the deformity does not resemble the cleft of the hare's lip, which is located in the median line bifurcating to each nostril (Fig. 1); but may affect any part of the lip. The cleft in the lip of the human being may exist as a mere notch in the vermilion border or it may continue into the floor of the nose, alveolar process and palate, forming a complete fissure in both the hard and soft portions of the latter.

An alveolar cleft (Fig. 2) seldom occurs in the absence of harelip. The modifications of this deformity vary greatly in different patients. I have been unable to obtain any statistics concerning the proportions in which these different forms exist.

Cleft palate is either congenital or acquired and involves a part or all of the hard and soft palate. The variations in the extent of this defect are equally as great as those of harelip. In extreme cases the cleft extends from the tip of the uvula to the anterior palatine canal, where the fissure bifurcates to communicate with a double alveolar cleft permitting the forward displacement of the central portion of the intermaxilla or os incisivum. (See Fig. 3.) This deformity is frequently called "wolfrachen" or "wolf's jaw" by the Germans.

The degrees of cleft palate may be classified under five main headings:

1. The cleft involves the hard and soft palate, the alveolar process, and the lip.

*Read before the Wisconsin Surgical Association, 1918 Meeting.

2. The cleft involves the hard and soft palate only, having the anterior alveolar process and the lip normal.

3. The cleft involves only a portion of the hard palate and all of the soft palate.

4. The cleft involves all of the soft palate only.

5. The cleft is a mere bifurcation of the uvula.

An accurate description of each defect that has come under my observation in literature and practice would require far too much space since the forms of cleft palate and the degree of the cleft are diversified.

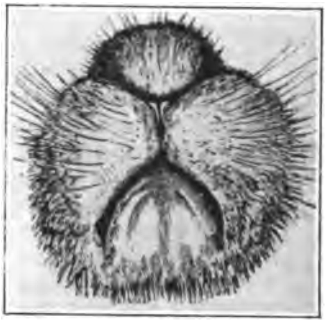

Fig. 1.—Hare's lip showing cleft in median line.

Fig. 2.—Showing an alveolar cleft and cleft of lip.

Fig. 3.—Showing protruding os incisivum attached to the tip of nose.

ETIOLOGY

Hypothesis and theories have been advanced to be almost as quickly rejected by later writers. At one time being very much influenced by the theory of maternal impressions and not having studied sufficiently the development of the oral nasal area in the embryo, I wrote an article which was published in the *Dental Items of Interest* entitled: "Maternal Psychism—Its Effect upon Dentition." Since contributing that article my conclusions on the subject of psy-

chism in its relation to fetal life have become somewhat altered. I am convinced by study and research work upon the etiology of cleft palate and harelip that maternal impressions can not produce cleft of the palate after the ninth week of fetal development. Nevertheless I believe that the opinion of scientific men will be influenced by further research and study upon the subject of heredity, which is accepted by most men as a factor in producing these deformities.

I always try, in my practice, to detect by careful questioning some circumstances which might disclose the exact cause of the deformity. Frequently a mother tells me that she was frightened by seeing something that resembled the defect in her infant. This can hardly be considered since the element of imagination enters in so strongly. Inquiry usually discloses in the great number of cases that some relative of the infant had or is suffering from a similar deformity.

In one family I operated on a brother and a sister, each of whom had a cleft of the soft palate. In another family I operated upon an eleven-month child who had a harelip and soon afterward another child was born who had a hare lip and a complete cleft of the palate, but who lived only a few weeks due to lack of the proper amount of nourishment. In this same family the third child was born normal. The fourth child had a complete cleft of the hard and soft palate, a double alveolar cleft, and a double harelip. This child I operated on and closed the alveolar cleft and harelip, the hard and soft palate will be operated on later.

Berry and Legg observed that a great difference in the ages of the parents will cause children to be affected, but more often those born at the beginning or end of a large family.

Embryologists consider that morbid intrauterine or placental conditions are the commonest causes of the want of union of the primary processes which go to form the palate.

It has been observed that other deformities, such as spina bifida, or club foot are associated with harelip and cleft palate.

TREATMENT

The treatment of harelip is surgical, the cleft of the palate is surgical, or it may be both surgical and mechanical or mechanical only. That depends on the judgment of the operator. Before attempting to remedy these defects the operator should be well informed on the advantages and disadvantages of surgical interference or the substituting of a mechanical appliance for the restoration of function.

I have had the opportunity in my experience to observe a large number of cases where surgery was resorted to for the correction of a cleft palate defect, the end result being anything but satisfactory. In other cases I have observed patients wearing an artificial palate and velum which did little or no good in the restoration of function.

I do not consider that a set of unalterable regulations can be established

as to whether a mechanical substitute or surgical correction is best suited for the patient; but I do know that unless one has had a training in both surgery of cleft palate and mechanical restoration he can not be in a position to judge what is best fitted for the patient's welfare. As I have said before, cleft of the lip is corrected surgically. I always prefer to operate on patients having a harelip within a few weeks after birth. However, if the cleft involves the lip, alveolar process and palate, I close the alveolar cleft first.

The surgical repair of congenital clefts of the palate and alveolar process depends largely upon the degree of the deformity, the age of the patient, and whether the patient has sufficient vitality and resistance to withstand the shock of the operation or any complications which may arise. It is impossible to lay

Fig. 4.—Showing the vomer cut so that the os incisivum can be forced into its normal position.

down any hard and fast rules as a guide in the treatment of these cases. The best age for the correction of the alveolar cleft is, obviously, a few weeks after the birth of the child. The bones at this period are not fully calcified and therefore can be easily brought together.

In patients who are suffering from a double alveolar cleft where the central portion of the os incisivum is displaced forward and attached to the tip of the nose, I usually perform a submucous resection of the vomer by removing a V-shaped section. In other cases, it is only necessary to split the vomer to allow the septum to overlap when the protruding os incisivum is forced backwards. (See Fig. 4.) If, however, the os incisivum is undeveloped or at an age when tooth eruption has taken place it is impossible to follow the above method. Therefore, I consider it good surgery and far more practical to remove the protruding mass and prepare this area to act as a good stump for artificial restoration. This is best illustrated in the following case:

Name.—W. V. M. *Sex.*—Male. *Age.*—4 years.
Nativity.—American. *Color.*—White. *Weight.*—34 pounds.
Complaint.—Harelip and cleft palate.

History.—One of twins, youngest of family of five, three older children

Fig. 5.

Fig. 6.

Fig. 7.

and twin brother normal. No history of harelip or cleft palate among relatives on father's side, mother, however, being left an orphan in early childhood, does not remember relatives.

Patient strong at birth, and suffered no children's diseases excepting cholera-infantum, was bottle fed, always healthy and playful, and is now a well-developed child.

Examination.—A double cleft of the upper lip extending into each nostril (see Fig. 5); a double alveolar cleft (see Fig. 6); a very marked protruding premaxillary bone holding two central incisors (see Fig. 7). The clefts of the alveolar process united with a medium-sized cleft of the hard and soft palate.

The mouth was fair as to cleanliness, the mucous membrane normal, and no visible gingivitis or pericementitis. There were occlusal cavities in the lower second deciduous molars, the tonsils normal, and no enlarged adenoids.

Patient was referred to Marquette University Oral Surgery Clinic, Trinity Hospital, April 2, 1918, and prepared to be operated April 4, 1918.

Urinary analysis: normal.

Fig. 8.—Showing the premaxillary bone wired in its new position.

Blood: normal.

Patient was admitted to operating room at 7:45 A.M., and put under ether anesthesia.

Under the anesthetic further examination revealed that the protruding mass contained two centrals which were tipped lingually. In this case, the two lateral halves of the upper jaw were very well developed and held the following well-developed deciduous teeth *5432|2345,* the occlusion of these being in normal mesio-distal relation.

The shifting of the protruding mass distally would not permit the closing of the alveolar cleft, for the mass in itself was too narrow to complete the normal upper arch, and the anterior wall of the bone was found to be badly developed. The mass was ovoid in shape and stunted, evidently due to the absence of lateral support and failure to functionate.

In many cases of double alveolar clefts we find that the os incisivum is usually larger than the mass herein described. It forms a projecting tubercle, covered by smooth mucous membrane on the inner side, with the central portion of the upper lip attached anteriorly. In an infant it should contain the tooth buds of the temporary and permanent central incisors, arranged in pairs, one above the other. This type of oral deformity is of the most pronounced kind, yet, when operated upon at an early age (from one to three months) and the os incisivum well developed and large enough to close the alveolar cleft, I do, as said before, a submucous resection and cut the vomer. This permits the forcing of the displaced os incisivum backward so as to form a satisfactory alveolar arch. The bone is then held in its new position by passing a silver wire through the vomer as illustrated in Fig. 8. In this way there is no injury done to the unerupted teeth. The borders of the alveolar cleft can then be cauterized several days later in order to get the tissues to unite in their new positions.

This, however, could not be done in this case since the os incisivum was undeveloped holding two centrals which were tipped lingually. Therefore, in

Fig. 9.

view of the situation, Dr. A. Trigg, a prosthodontist, and I decided that it would be good surgery and far more practical to remove the protruding mass and prepare the vomer bone to act as a good stump for the artificial restoration of two central incisors. This was done under the following technic.

The mucoperiosteal flap on the labial and lingual surfaces was dissected and the mass, containing the two deciduous centrals and the tooth buds of the permanent centrals, was removed (see Fig. 9). The flaps of the soft tissues were then brought in contact and stitched on to the lateral halves of the jaw bone so as to close the anterior portion of the floor of the nose. There remained only the cleft of the hard and soft palate. Following this operation, the double cleft of the lip was closed by bringing in contact the soft tissues which covered the protruding mass and the borders of the lip on each side. The vermilion surfaces were carefully joined and the alæ of the nose were turned inward so as to give the boy the proper shaped nostrils. Paraffin silk was used to suture the soft tissues (see Figs. 10 and 11).

The wound was kept clean by gently washing it with boracic acid solution.

On the eighth day the stitches were removed (see Figs. 12 and 13), and the lad was then able to function his lip normally.

In about six months or longer the cleft of the hard and soft palate will be closed. In order to keep the space open between the laterals, an orthodontic retaining wire will be fitted and adjusted so as to promote the space which, at a later date, can be restored with a well-fitted anchor denture holding two centrals.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

In the treatment of single alveolar clefts it is customary for some operators to close the cleft under the Brophy technic at an age when the bones will yield, which is usually within six or eight weeks after birth. This method of treatment, I admit, will close the cleft but I have abandoned such procedure be-

cause the passing of the wires through the alveolar process usually destroys the tooth buds of a number of teeth. The end result of this technic as the years go on has proved to me that the loss of several teeth is a factor in robbing the upper jaw of normal development. It has a tendency to start a so-called progressive malocclusion and the jaw remaining stunted leaving the patient with an infantile jaw technically called a micrognathia. (See Figs. 14 and 15.) The expression of the face is anything but satisfactory, the lower jaw protrudes while the upper jaw seems to be sunken in. While it is true that many of these cases

Fig. 14.—Showing undeveloped upper jaw from loss of teeth due to passing silver wires through jaw in infancy for repair of cleft palate.

Fig. 15.—Palatal view of same case shown in Fig. 14.

Fig. 16.- Showing loss of teeth, caused by passing silver wires through jaw.

can be benefited by orthodontic treatment in expanding the upper arch, orthodontists agree that to accomplish this, there must be sufficient number of teeth to produce a development of the jaw.

This can best be illustrated by studying Fig. 16 showing the palatal view of a model of a young lad who was treated in infancy by a surgeon who closed the alveolar cleft under the Brophy technic. The bicuspids, the upper left lateral and the upper right cuspid have been destroyed. The only permanent teeth he has are *621 | 16,* the remaining teeth are deciduous. The centrals are in marked linguo-version giving the boy the appearance of having a marked de-

pression in the region of the upper lip, while the lower jaw seems to be protruding. In order to stimulate a development of the jaw by orthodontic treatment, it would be advantageous and the prognosis very favorable if the teeth had not been destroyed at the time the boy was operated upon.

Let us compare this case to Figs. 17, 18, 19, and 20. This shows the result which can be achieved in developing the upper jaw, restoring the forces

Fig. 17.—Showing pinched face due to contracted upper arch and pronounced malocclusion.

Fig. 18.—Showing palatal view, the contracted arch and the result obtained under orthodontic care.

of mastication, improving the facial expression, and enlarging the nasal channel. In this case there were sufficient number of teeth to fit the proper kind of appliances to obtain the right result. The object of comparing these two cases is to impress upon operators the importance of preserving the deciduous and permanent teeth when operating upon cleft palate cases, in order to permit further care, if necessary, through orthodontic means.

For this reason I have discontinued closing the alveolar cleft by passing wire through the lateral halves of the jaw and forcibly closing the cleft. In infants, I prefer to close the harelip first and depend upon the lip function to mold the arch. This is usually accomplished in about 18 to 24 months. I have had a number of cases showing the borders of the cleft of the alveolar

Fig. 19.—Showing improvement in facial expression.

Fig. 20.—Showing restoration of occlusion.

process to come in contact much earlier. All that is necessary then is to cauterize the epithelial covering of each border so as to permit the parts to unite and then at a later time to close the palatal cleft which will be described later.

In some patients where the child is older than eight weeks and the cleft is very wide, I use adhesive strips as illustrated in Fig. 21 for several weeks or

longer. This is done by drawing the soft tissues of the lip together and attaching the tape, repeating this treatment every day until such time when I find that the lip can be closed without too much tension. If the patient is at an age when the tape or the closing of the lip will not permit narrowing the gap, I close the cleft by producing a green stick fracture of the alveolar process, thereby preserving the shape of the arch. This is best illustrated in the following case:

Patient, E. S., female, nine years old, excellent health, had congenital cleft of the lip, alveolar process and soft palate (see Fig. 22). Notice the alveolar process is divided between the left central and the rudimentary left lateral. The alveolar process on the right side was turned outward and protruded to such an extent that it caused a distortion in that region. It was necessary to reconstruct the shape of the dental arch before doing anything further. The patient was anesthetized under ether, an incision was made between the right deciduous cuspid and right permanent lateral. The mucoperiosteal flaps were

Fig. 21.

Fig. 22.—A complete cleft palate and harelip.

raised and retracted, the exposed bone was cut one half its thickness by a narrow long fissure burr; then by forcible pressure the protruding alveolar process containing the lateral and two centrals was brought in contact with the alveolar process on the opposite side, thus producing a green stick fracture. The borders of the cleft were freshened and held together with an orthodontic appliance (see Fig. 23). The patient's mouth was kept as clean as possible and four weeks later after union had taken place, the appliance was removed. This operation restored to a fair degree the shape of the dental arch, and as a result the cleft of the lip became narrower. When I operated upon the patient the second time for the correction of the lip, I obtained better results than if I had attempted closing the lip before the shape of the dental arch had been restored (see Figs. 24 and 25).

After the correction of the alveolar cleft and the cleft of the lip, the patient is usually discharged for about six months, at which time the cleft of the palate is closed.

In order to fully appreciate my method in the relief of lateral tension in cleft palate operations, I will describe the technic of combined uranoplasty and staphylorraphy. The method universally employed is Langenbeck's which consists of the following steps:

1. Freeing of mucoperiosteal flaps.
2. Freshening the edges of the cleft.
3. Placing and tying of sutures.
4. Relief of lateral tension.

Fig. 23.—Showing method of immobilizing the fractured bone with an alignment wire to which the anterior teeth were ligated.

Fig. 24.—Harelip. Note the width of the cleft. This same cleft became more narrow after the alveolar cleft was closed.

Fig. 25.—Another view of same patient after being operated.

FREEING OF THE MUCOPERIOSTEAL FLAPS

This procedure is accomplished by cutting the mucous membrane along the entire borders of the cleft and separating the soft tissue by periosteal elevators and cutting the tissue loose from the distal surface of the horizontal plates of the palate bone. This should be done with great care in order to prevent tearing or lacerating, which may seriously impair nutrition. Naturally this brings on considerable hemorrhage which can be stopped by firmly pressing a sponge gauze against the bleeding surface. It is not always possible to

avoid wounding the anterior palatine and especially the posterior palatine artery. Should one of the vessels be nicked it will cause severe and prolonged hemorrhage. It is therefore better to completely divide the vessel so that it will contract at its ends, thereby overcoming protracted bleeding.

FRESHENING THE EDGES OF THE CLEFT

This can best be accomplished by grasping the uvula on one side with a catch forceps and putting tension on the soft tissues, then with a very sharp

Fig. 26.—Showing lead plates with wire ligatures cutting through the soft tissues.

Fig. 27.—Type A. Author's tension plates.

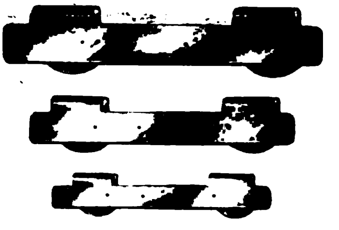

Fig. 28.—Type B. Author's tension plates.

thin-bladed knife cut a thin marginal strip along the entire flap from the uvula to the apex of the cleft. This same procedure is to be carried out on the opposite side. The freshened surface should be cut square with the flap tissue. A beveled surface is conducive to inviting failure. If the raw surfaces are cut square, it is an easy matter to bring them together in close apposition which will enable rapid union during the healing period. In cases where there seems to be a shortage of tissue in the soft palate I prefer to split the border of the velum about one-eighth of an inch and then unite the raw surfaces.

PLACING AND TYING OF SUTURES

Various kinds of suture material has been adopted for holding the pared edges together, such as silk, horse-hair, linen, catgut, wire, etc. Personally I

Fig. 29.

Fig. 30.

do not believe that the difference in value of the above-named suture material is of any great consequence, provided the operator does not depend upon the same to overcome lateral tension. Sir William Ferguson, in 1844, recognized that the tension on the ligatures frequently invited failure, either through their cutting out or by shutting off the circulation, thereby bringing on starvation, necrosis and infection. To overcome this tension Ferguson divided the levator palati, the palato-glossi, and the palato-pharyngeal muscles. In 1860 Doctor Agnew believed that the tensor palati muscles were responsible by pulling the newly approximated surfaces on the soft palate apart, thus causing the sutures to pull out. Therefore he advocated making an incision close to the hamular process of the sphenoid bone, and in this way overcoming tension. For a long

Fig. 31.

time these methods were extensively adopted by operators in this and foreign countries. The end results were not satisfactory. This was pointed out in a paper by Doctor T. W. Brophy in 1901 in which he says, "The formation of cicatrices following incision renders the soft palate thick and unyielding, so that its function is performed imperfectly." Brophy finds it unnecessary to cut the muscles on either side, it was he who introduced the application of lead plates. The advantages claimed for these plates are to render the palate inflexible and the prevention of the cutting out of the sutures. Blair reports that he has discontinued the use of lead plates as a retention device because they occasionally caused sloughing, in spite of every care; he depends entirely upon the sufficient freeing of the flaps. In my experiences I have never found that the plates cause sloughing, but that they did not prevent the cutting out of the sutures (see

Fig. 26). They are, however, of a distinct advantage in rendering the palate inflexible. In order to prevent the cutting of the suture through the soft tissue I have devised a new tension plate which will prevent the suture material from cutting out and at the same time relieve the tension as well as render the

Fig. 32.

Fig. 33.

Fig. 34.

palatal tissues inflexible. These plates are made from noncorrosive metal B.I.B. American gauge 22, in various sizes and types. (See Figs. 27 and 28.)

The object of these plates is to prevent the cutting out of the wire ligature which frequently happens with the Brophy plates. In order to fit these plates it is necessary to make a small incision near the gingival border of the

last molar, being careful not to cut the palatine artery. (The operator must take into consideration the degree of the cleft, the position of the blood vessels and the type of plate that best suits his purpose.) The incision should be of sufficient length to permit the flange of the plate to enter and lie between the palatal bone and soft tissue. Previous to fitting these plates it is necessary to pass silver wire (American gauge 24) through the mucoperiosteal flaps and then through the holes in the plates. The ends of the wire are then passed through perforated lead shot and made tense by pulling the wire and crushing the shot after the borders of the flaps can be approximated without tension. After this is done I denude the border of the cleft and then place and tie the coaptating sutures after the McCurdy method.

While to the beginner it is rather a difficult procedure to properly fit these plates he can, with a little patience, soon master the technic of this simple procedure as an aid in obtaining uniform anatomic, as well as physiologic results.

Fig. 35.

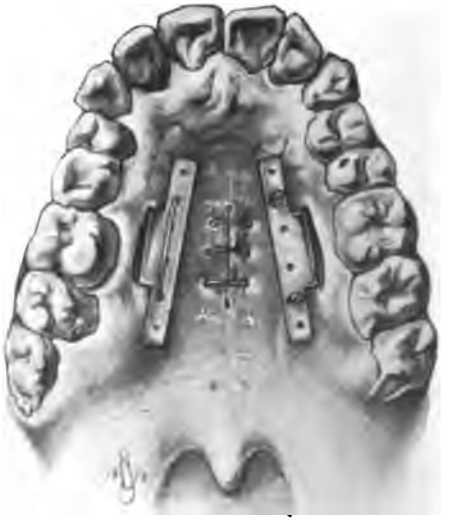

Fig. 36.

Fig. 29 illustrates the cleft of the hard and soft palate. Fig. 30 shows the same case with the plates in position. Fig. 31 shows the same case and the operation completed. These plates are now relieving the center ligatures so that healing can take place without tension.

Fig. 32 shows an extensive cleft of the hard and soft palate. This patient, for years, had been wearing an obturator. Fig. 33 shows same case with the palatal opening closed and held so with Type B tension plates. Healing took place rapidly in this case and the patient was discharged ten days after the operation.

Fig. 34 illustrates the so-called "button-hole" opening in the center of the palate. This form of opening usually is the end result of an attempt to close the hard and the soft palate. Figs. 35 and 36 show the advantage of using the author's Type A tension plates for closing the opening shown in Fig. 34.

DENTAL ENGINEERING—IS IT JUSTIFIED?

By Rudolph L. Hanau, Pittsburgh, Pa.
Consulting Dental Engineer

It is my purpose, at this time, to treat, philosophically, the general aspect of present day orthodontia. I shall not, while so proceeding, allow egotism to mar our searching and reasoning.

If it happens to devolve upon me just now to lead in the propagation of the science of dental engineering, I bespeak, for myself the sympathy, rather than the envy or jealousy of the profession, for I seek nothing but its enlightenment and progress. I shall adopt the plural, for I am now conscious of the moral support of the best brains in the profession, and shall never again have to stand alone in defense of my doctrine.

We shall take as a basis for our philosophic reasoning today, an article "Dental Engineering and the Normal Arch" in the *Dental Cosmos* of June, 1918. We shall assail the article in a manner exactly as if it were anonymous. We must show and prove the fallacy of pseudoscience. Be assured that whenever this counterfeit dares to distort in the sun of science it will suffer annihilation. Permit us to cite: "Dental engineering is a term which has been applied so often in describing orthodontic treatment during the past three years that the expression has found a permanent place in dental literature. If we are to accept dental engineering and allow it to become a part of our science, it is well that we clearly understand what it means, and its relation to Nature's methods of arch construction. In the first place, all branches of engineering are based upon exact mathematical formulæ, and variations are always considered. Nothing is allowed for variation until the amount of variation has been carefully computed. The finished product must comply absolutely with the predetermined result.

Engineers always assume that if no error has been made in the mathematical calculation, the desired work can be accomplished, and right here we meet the first obstacle in applying engineering methods to orthodontia."

This rendition presents engineering as a dogma, which it is not; permit us, therefore to present it as a *science*, which it is. There is not an engineer in this wide world—not one who deservedly attained his degree—who does not allow, in his calculations, for natural contingencies, of which there are many; and the greater and more learned the engineer, the more circumspect will he be in making these allowances. Let us take, for example, the planning, of a cable-suspension bridge. We shall not go into wearisome details, but state briefly, and lucidly, the most important factors. The bridge is to be held by four cables. After computing the total weight to be borne by the cables, the carrying strength of the cables is scientifically calculated. After that, allowances are made, in addition to mathematical certainties, and, in making allowances, science and Nature are linked. The engineer will reason with himself as to the contingencies which Nature will sooner or later provide and which

may impair its carrying capacity. There are, of course, many contingencies which Nature,—not science—brings about, but all thinking men know that competent engineers must, necessarily be scientific, and that they must and do reason with Nature as to her terms—present and future. Nor do competent engineers ever neglect, after having contemplated a safe structure, to create it as beautifully as is consistent and harmonious with surroundings and perspective and with the funds available for the purpose. Every engineer, worthy of the name, leaves nothing, absolutely nothing, to chance; neither does he depend on Nature, for Nature is both creative and destructive; he simply adheres to scientific principles, and goes so far as to anticipate and correct the shortcomings of Nature. Exactly what the modern orthodontist should try to do.

We shall hereafter be so forcible in conveying scientific doctrine that "reactionaries," and "straddlers" will not assail science without the danger of being classified as outside the pale of science. We shall put forth the laws of physics, the tenets of applied science, and the reasoning of an unshakable philosophy. We have heretofore, refrained from taking this advanced stand, but now that we are assured of the moral support of a goodly number of practicing orthodontists and students—men of open mind who prefer to learn truth, rather than stick to false prophets—we shall proceed to preach the gospel of science in a way which will attract the seekers after light and repel all others—especially the straddlers who deal out thick hunks of bread of ignorance covered with a grudgingly sparse layer of the butter of science.

The writer of the aforesaid article deprecates the enterprise of scientists who dare destroy the idols of ignorance and mediocrity, and he, in grandiloquent fashion, confounds them with the astounding indictment: "Fools rush in where angels fear to tread." It does not take a very keen sense of discernment to determine that our friend has ranged himself with the angels, and, it does not require superheroism on our part to insist upon living up, with the fools—nor are we the first and only fools in the "rush" line. Socrates, Columbus, Newton were fools who rushed in where angels feared to tread. We do not claim to be *such* fools as those we named, yet we emphatically disclaim all relationship to the angels.

Lest a false impression obtain that injured pride causes us to attack those who dare assail us, let it be stated, as a matter of fact, that the foregoing is a counter attack, in other words, a defensive stroke, calculated to parry an attack upon science. While such offense could not, possibly, penetrate the armor of science it might—if not thrown back—injure many recruits of science, and destroy much human material worth saving, including possibly the aforesaid oracular author himself.

It is our avowed purpose—paradoxical as it may seem—to convert the angels, and make it possible for them to enter the kingdom of fools. Our catechism of conversion may be terse and tough, but this is justified by the certainty that we can not make scientific thinkers and workers out of vague, scintillating bipeds by feeding them delicious angel food. They must be made to quaff copious drafts of physics in order to condition themselves for

the comprehension and adoption of science. We, on our part, shall keep up courage, and look hopefully forward to the time when many of the present-day scoffers will sincerely endeavor to obtain a fool's license.

We shall not try to correct or clarify some of the passages in our friend's article, because, frankly, one can not make head or tail out of them, and there is, moreover, a general aversion to the dissecting of hash. We will, however, take up the paragraphs which are sufficiently clear, for the purpose of demonstrating certain truths.

He writes: "Engineers always assume that if no error has been made in the mathematical calculation, the desired work can be accomplished, and right here we meet the first obstacle in applying engineering methods to orthodontia. In the first place, Nature does not grow flowers, animals, human beings, or dental arches to mathematical exactness—the almost infinite number of variations is one of the charming things in Nature; but, while not arbitrary, she does follow certain well-defined laws."

We observe that the distinguished author sets up the pins of a pre-science era in a neutral alley, and then, (unconsciously, we presume) straying into the fools premise, proceeds to bowl them over,—all of them, with lignum vitæ formed into a sphere of science. We applaud the "ten strike," but we deprecate the waste of energy which the setting up of the pins necessitates. He states a truth when he says: "Nature follows certain well-defined laws." We agree. Nature does follow certain well-defined laws. Nature *does* grow flowers, animals, human beings and dental arches in accordance with certain well-defined laws. *If, however,* Nature, in the growing of a certain dental arch, through influences which may or may not be readily determinable, has strayed from the course of those certain well-defined laws, then it becomes the mission and duty of the scientist to correct Nature, or, rather, bring strayed Nature back to herself, and that, precisely, is what we intend to do, and will do.

Our friend writes: "Another and more serious difficulty in applying engineering methods to orthodontic treatment is that, once we adopt them, we become slaves to a system which is so exacting that it becomes impossible of realization." We reply: A system—though it be exacting is system; while so-called systems which are not exacting are not systems at all. And, if for the time of apprenticeship, we are made slaves to system, this transitory stage should be cheerfully endured in order that, after apprenticeship, the erstwhile slaves of system may become its masters—and this eventually is our goal. Let us read further: "Dental engineers work under the assumption that teeth can be moved to within one one-thousandth of an inch of some predetermined points, and rest their assumption upon the ability of the operator to move and place cusps, sulci, and planes in the exact position as shown on the previously laid-out chart." This is a specie of levity which can but spur us on to greater seriousness, and to the resolve to repel all attacks upon our science—whether direct or indirect—so that innocent readers who aspire to the attainment of knowledge, may not be misled, but on the contrary saved to science. We are, in this instance, constrained to observe that dental engineers only "assume"—and forever *"assume"*—that it is always not only a wise expedient, but also an

absolute law that the point nearest the truth and nearest perfection be attained, and we shall maintain this position, even at the risk of discomfiting metaphysicians, or quacks who prefer to grope along dark by-ways that they may go on practicing make-shifts amid the fogs of uncertainty.

We now proceed to a remarkable paragraph, one that pulsates with the epigrammatic wisdom of the oracles: "The proverb that 'Fools rush in where angels fear to tread' can be appropriately applied to the man who knows all about engineering, but little about orthodontic treatment. Such a man gets an idea and allows it to dominate him, distorting his judgment and pushing aside every other consideration to accomplish the purpose." Who among those of us who prefer to align with the fools is so immodest as to see this oracle's finger pointed at him? Let the man who knows little about orthodontic treatment but who knows all—all, mind you—about engineering, rise, that we may acclaim him; for he who knows all about engineering is deserving of the laurel, being, as it were, in a class by himself as an engineer, and, as to little about orthodontic treatment, he is in a class with at least 75 per cent of practicing orthodontists of the present day.

We read further: "Most of us who have moved teeth for any length of time know that when we place teeth in positions which approximate occlusion, Nature comes to our aid, and by means of dynamics and the inclined planes proceeds to occlude the teeth, and she can do with her methods what man has failed to do since time immemorial. It is fortunate for most of us that this is true, and it is my contention that even if man possessed the ability to place cusps to within $\frac{1}{1000}$ of an inch of the position as indicated on a chart, this is wholly unnecessary." We must again accentuate that it is not only desirable but imperative as well that, to the utmost of our ability, we approach truth and perfection, for this task is imposed upon us—not alone by science, but also by good morals. When our friend declaims upon the work which Nature does gratis for man, we—all of us—join in praise of and gratitude to Nature, especially those of us who are scientific enough to comprehend that if Nature ever "went on a strike" there would become visible on the horizon of all who are not blind, an endless line of impotent, groping, demoralized practitioners of orthodontic guesswork. Luckily, we are happy to say, there would appear, also, upon the horizon, a beacon of light, in the form of a small—a very small—minority of orthodontists, practitioners who had been seekers after truth, slaves of system who had never been satisfied to drift with the mediocre, and who had never descended to the level of the scoffer; and upon this small minority would devolve the task of delivering, through acquired science, suffering humanity, upon them would fall the task of setting right the multitude of their erring brothers who forever depended and depend upon Nature to come to their aid, to correct their malpractice, to smooth over their rough work, and who never, or very rarely, volunteer, on their part, to come to the aid of Nature and thus to live on terms of reciprocity with her. We reiterate: It is our everlasting purpose to assist Nature in order that we may approximate the perfection which is her goal and that, also, of scientists everywhere.

We are further instructed, as follows: "It is of course true that occlusion is largely a mechanical problem, and as such it is closely related to mechanical engineering, but we must always have in mind that a working formula to be of any value must be capable of execution. That there has been and still is a need for some method of predetermining the shape of the arch none of us will dispute." In this paragraph our friend comes dangerously near deserting the camp of the angels, and dropping into the trenches of the fools. If he persists in this careless abandon we may yet capture him. He continues: "Ever since orthodontia became a specialty the need for this has been constantly seen, but little has been done to that end. For years the Hawley charts remained the only guide for arch form, and we must concede that they were better than nothing." In the vernacular—What do you know about that? Our friend actually admits that it is better to have order than to have chaos. Good! On the same hypothesis: if order is desirable, is not system more desirable, and science most desirable?

Our friend complains: "We have for a long time paid altogether too much attention to designing appliances and perfecting technic without due regard for a great and fundamental problem, that of determining arch form. The ease with which the profession becomes obsessed with a desire to perfect technic was seen some years ago when members of the profession reached such a high degree of skill in manipulating noncohesive gold foil, some men even going so far as to fill root-canals with this material. It has since been seen that this took precedence over some equally if not more important problems." We agree, in general, with these remarks; but must demur to the assumption that the activities in so-called "perfecting technic" accomplished, in fact, the perfecting of technic, and we maintain that perfecting technic is possible only if technical perfection—or the approximate equivalent—can be the ultimate result, and that this ultimate result is unattainable unless planned and pursued on purely scientific principles. It follows, therefore, that many activities in the line of so-called perfecting technic were nothing more or less than heterogenous excursions, inasmuch as they were unscientific, and, hence, could not attain approximate truth and perfection. We do not say that certain appliances which now are discredited, have never led to comparatively satisfactory results, for that would not be consistent with the truth. Moreover, *comparatively satisfactory results are sometimes attained even though wrong hypothesis, wrong diagnosis, and wrong treatments be applied.* Which reminds me of a joke, pardon the digression!

A physician had a patient, a cobbler, who was near death, with typhoid. He told the cobbler's wife that her husband had but a few hours to live. The physician called the next day, presumably, for the purpose of writing the death certificate. He found the cobbler reading, seated in a rocking chair, and laughing most insolently,—the physician thought—over the exploits of Don Quixote. The learned doctor stood and wondered. When, at last, he had convinced himself that it was the cobbler who was holding the heavy volume, and not his ghost, he asked the wife: "How did it happen?" She answered: "He pestered the life out o' me to cook him a mess of sauerkraut, and, you

told me he had only a few hours to live, anyhow, so I thought I might as well let him have his wish. He sure relished that sauerkraut, and after awhile, when I came back into the room, I found him dressed, and reading, as you see him now." The doctor examined the patient, and found him virtually normal and well. He thereupon made the following note in his reference book: "Sauerkraut is a potent specific for typhoid." Some months thereafter the wife of a tailor came to his office, and begged him to come at once to her husband, who, she said, was deathly sick. The doctor hastened there, and found the tailor in the throes of typhoid, his symptoms being almost identical with those of his recovered cobbler patient. He, accordingly, told the wife to feed him a liberal mess of sauerkraut. When the physician returned the next day he found a crepe at the door. He immediately drew his reference book from his pocket, and wrote: "Sauerkraut is good for cobblers but bad for tailors;" hereafter I'll stick to science.

Let us emulate the final resolve of that physician; let us stick to science; let us, hereafter, whenever we are in danger of sidetracking science for guess-work, makeshift or "take a chance" work, recall—for the purpose of stabilizing the scientific tendencies of our intellect—both the sauerkraut joke and the famous, or infamous, appliance joke.

We observe that our friend makes some remarks over which might appropriately float the standard of truth; he does so whenever he hews close to the line of science. As a whole, however, such propaganda is more dangerous to scientific progress than out and out opposition, because it offers to all who read it the flowers of science and progress, so intermixed with the weeds of complacent drifting, and the poisonous toadstools of veiled encouragement to the ignorance-loving stand patters and poison ivy of grudgingly granted truths, that we have no choice but to condemn it as unwholesome diet for all who seek unmixed truth and unadulterated science. Away forever with orthodontic hash!

In order to make orthodontia an absolute science two capital principles must be observed: First, the throwing overboard of all orthodontic quacks, witches, guessers, take-a-chancers, sole-dependents upon Nature, and of all who make their patients the subjects of their ignorance by clumsily experimenting upon them; and second, a strict, faithful, uncompromising adherence to the laws of science,—an adherence which can not and will not tolerate the contaminating association with any and all orthodontic alchemists who mix 1 carat of the gold of science with 23 carats of the mica of quackery, and who then proclaim: "Behold, this is science!"

In order to be able to strictly, faithfully, uncompromisingly adhere to the laws of science, it is, primarily, necessary to have acquired a knowledge of the laws of science. How, then, can this knowledge of the laws of science appertaining to orthodontia be acquired? Through the study and mastery of *dental engineering.*

There are those stand patters who will forever argue that Nature and common sense are the orthodontist's best and most potent allies, to which we reply: "It takes two to make a bargain;" for we believe that Nature and common sense are unwilling to choose, as allies, unprogressive or retrogressive

practitioners. Whatever Nature accomplishes for orthodontia, it does, not because of the inefficiency of the unscientific, but notwithstanding or in spite of it; and as regards common sense, we are sure it would rather be a free lance than be linked with (or defamed by) facile stand patters. We will take the liberty of penetrating the camouflage and of ascertaining the facts. What philosophy teaches that Nature and common sense are opposed by or to science? None! On the contrary, Nature and science are inseparably linked, while common sense indicates the road to wisdom, while wisdom and science are twins.

We do not mean to denounce as outcasts all orthodontists who have not, heretofore, studied, along the lines of *dental engineering,* but we do declare that knowledge of dental engineering is as necessary for the scientific prosecution of orthodontic work as is knowledge of statics, etc., for the work of bridge construction, and that, therefore, the study of *dental engineering* must be taken up by orthodontists, else they will, automatically, be classified as unscientific. It will be our pleasure to cooperate to the end that orthodontists may attain as great a degree of proficiency in dental engineering as either their mental capacity or their moral desire—or both—can encompass.

Utilization of Platinum in Unused Instruments

In view of the limited supply of platinum in the country and of the urgent demand for war purposes, it is requested that every doctor and dentist in the country go carefully over his instruments and pick out *Every Scrap of Platinum* that is not absolutely essential to his work. These scraps, however small and in whatever condition, should reach Governmental sources without delay, through one of two channels:

(a) They can be given to proper accredited representatives of the Red Cross who will shortly make a canvass for that purpose.

(b) They may be sold to the Government through any bank under the supervision of the Federal Reserve Board. Such banks will receive and pay current prices for platinum.

By giving this immediate attention you will definitely aid in the war program.

It is recognized that certain dental and surgical instruments requiring platinum are necessary, and from time to time platinum is released for that purpose. It is hoped, however, that every physician and every dentist will use substitutes for platinum for such purposes wherever possible.

You Are Warned against giving your scrap platinum to anyone who calls at your office without full assurance that that individual is authorized to represent the Red Cross in the matter.

Lieut. Col. F. F. Simpson, M.C., N.A.,
Chief of Section of Medical Industry,
Washington, D. C.

PRESIDENT'S ADDRESS DELIVERED BEFORE THE AMERICAN SOCIETY OF ORTHODONTISTS, CHICAGO, ILL., AUGUST 1, 1918.

By D. Willard Flint, D.D.S., Pittsburgh, Pa.

"WHAT we call trifles are the hinges on which swing open doors of destiny" was the subject of a discourse I heard in Ann Arbor some twenty-three years ago. It has been ringing in my ears ever since, so that it has made a deep and lasting impression upon my mind. It might have been a "trifle" that to my lot was given the privilege of teaching a class of boys and in that class to have one with a very bad case of malocclusion. This boy was taken to four of the best men in our city, two of whom were doing all the orthodontia work they could get, and yet not one of them would undertake the case. It might have been a "trifle" that I borrowed a paper-covered edition of Doctor Edward H. Angle's book and undertoook the case, before ever entering a college, and I may add that I am proud of the result to this day. Again it might have been a "trifle" that I should be introduced to Doctor Angle while on his way to Paris to read a paper and to have him personallly invite me out to St. Louis to study orthodontia with a class, yet to me, as I see it, it was but the step by step of gradually leading me to my life's work, and for every step of the way I am profoundly grateful.

It is worth while in youth to get a vision of some kind of useful constructive work, and I know of no body of men who are more fortunate than the men who have seen the possibilities which lie within our reach. Every day I see before me in motto form a truth from the pen of one of our members, namely, Doctor Rodrigues Ottolengui, which I feel ought to be engraved on the minds of the whole profession, and I want to here quote it as a creed and a classic:

"I believe medicine, the art that heals, to be the highest and noblest calling to which man may devote his life. And of all branches of the healing art, what more attractive, more beautiful, more honorable than to take into our care the children of men, and by our labors to make them more perfect and beautiful men and women?"

I prize highly my membership in this society, for to me it has furnished the opportunity of visiting our large cities from one coast to the other, many of them for the first time. This alone would have been worth while, but far greater than the visiting of the cities has been the opportunity of associating with kindred minds, and this morning I feel that we have a fraternity of feeling in this body, because of our years of association together, that is really worth while. We are receiving many new men and we trust that they soon will feel that they are a real part of our great body, and that we each will be indispensable to the others' welfare. I want right here to call attention to the fact that we must guard well our membership.

It was a source of grief to me at our meeting last year to find a goodly number of men that were recommended for membership and had actually been elected, who could not honestly have qualified, and mind you, it was not their fault. In this body the recommender is the one who should be held responsible as it is not possible for your Board of Censors to do otherwise than take the word of members already elected, as to the fitness of the applicant, and while we are on the thought there must not be any letting down of the bars into our society, for there are always those who seek to capitalize their membership in a society having standing and history.

Another annual session has rolled around and I must confess that my mind has been much more interested in things pertaining to the war than in sitting down and writing things orthodontic, and until my printed program arrived I had not even given it serious thought. However, we are in war, up to the hilt, and from even this distance we must confess and agree with Sherman that "War is hell," and what shall we say concerning it all?

I have postponed writing in the fond hope that we by this time might have seen the enemy crumbling, but it might be that a wise Providence has not yet seen that the time was ripe for a righteous victory, and that the animus of the enemy was not just ripe to put in the punch. However, we see clouds arising even if they are but "the size of a man's hand" and that victory is just behind the clouds.

Yes, I know there is a war during the week days and also on the Sabbath, for I am forcibly reminded that of the eighteen young men I have under my care, just one is left. All are in the service, and I would not have it otherwise, for they have caught the vision of an outraged world, and with real blood in their veins they have in their own way gone forth, to do their own work. Yes, and we who are home have a real work to do.

May I ask, "Are we losing or gaining in our loyalty and ability to render unselfish service?" Not many years ago we used to hear on all sides "the world owes me a living," but things have changed, it is not so much now "who is who as what is what." We must say "we owe the world everything we have—our time, our labor, our money—and that we will give ourselves unreservedly in service for the welfare of mankind."

At the battle of Austerlitz the soldiers wore on the lapel of their coats this motto "I was there." It will be, God help the fellow who, after this war is over, can not point with pride to the fact that he did his best in whatever way he was permitted to lend his energies.

Our membership is worth while; then let us not cheapen it but rather make it more worth while. Since copies of our proposed new Constitution and By-Laws were mailed out I have had numerous letters of protest against throwing open our membership, and I feel I do no wrong when I call your attention to the same. I am here reminded of the difference between the goods that are kept in glass cases in our best stores and the kind that everybody picks up, handles, throws down in our cheap stores. Those of the general profession have always been made more than welcome in our meetings, and have been shown every courtesy, but where could any line be drawn? They

are not thinking intensely along our special line and would have very little to offer, so I trust that wisdom will be shown when we come to deal with such an important matter, when the matter of changing the Constitution and By-Laws comes before you. I am proud of my membership in this society for another reason, and that is that in the sixteen years I have been a member and attendant, I have never been asked to vote for any one, or anything. The society is clean and absolutely free from politics and I trust the day will never come when we will have to stoop to anything that even looks little. I believe the informal ballot has been responsible for much that has been good in the past, and if I read the proposed By-Laws aright there is a proposition to change this.

Since Doctor Fred Kemple raised the question in Pittsburgh two years ago concerning the effect of continually keeping bands on the teeth, and the possibly injury that may come from a histologic standpoint, and not just from the physical, the thought came to me that I would make inquiry from the general practitioner who from time to time takes off gold crowns which have been on for considerable length of time, and then simply fills the same. The record I got from these doctors is very favorable to absolutely no change in the structure, and that the fillings so placed have been lasting indefinitely. Personally, I think the bands that we have made, have not been perfectly fitted and festooned under the free margin of the gums, or again, as the tooth has erupted more fully the bands do not perfectly cover the teeth or that the cement has washed out and thus we have incipient decay from that cause more so than from any internal weakness. This is a question that is before us every day, for every patient asks what effect the bands have on tooth enamel. I suppose I do not differ a great deal from each of you in that I tell them the ordinary process of decay comes from moisture, food and body temperature, and that when teeth are perfectly covered and the moisture is excluded by cement, how can they have trouble, except through willful neglect on either the operator's part or gross negligence on the part of patient's keeping the mouth clean? It satisfies them, but for my part I am not altogether so sure. There are some mouths that it would be a crime to leave a silk ligature on the way we tied them for rotation, for even one week. And then again, we can do anything that looks like carelessness and not a particle of harm come from it. While we are on this subject I would like to ask a fair question, even if I have to be the "goat." When a patient presents with every indication that the patient eats "jam on bread" before retiring for the night, do you undertake treatment in such a case or do you sidestep it altogether?

If we read our journals closely I think you will not fail to observe that as a result of neglect and imperfect dentistry, with focal infections as a result there is a wave of extraction going over the country that is appalling. The physicians will be more and more the abettors following the recent meeting of the American Medical Association here in this city a few months ago. The question that has arisen in my mind is, What shall be the attitude of our society when we know the disastrous results that follow indiscriminate extraction? If teeth have to be lost, what is our best manner of procedure to

hold the given space in order that occlusion might not be utterly destroyed, We surely need some sign posts.

Can orthodontia ever be democratized? One of the saddest things we have to contend with is the great number of cases that come to us and we deliberately send them away because we are too busy and simply can not take on more than our physical power and time will permit. Naturally we like to fish near the stream with the best fish. I would like to ask in the light of the fact that our schools are not equipping men properly, if the graduate dentist as an assistant would in any way solve the problem. Does the society know of any orthodontist who is thus trying to meet the needs of the people in just ordinary circumstances? If our work is good and necessary for one, it surely ought to be for all. "He merits most who serves best" is a slogan, which has but a veiled truth. If this were the case, many men of wealth in the commercial world would have filled the bill, but their names are a by-word, because all their endeavors have been for self. This war is teaching us many lessons in doing for the other fellow. To date for the most of us I think we would all have to plead guilty in catering to the wealthy rather than to those who have an aristocracy of the mind, but a trifle shy on the pocketbook.

In looking over the program I am pleaesd to see that we are going to have something on the x-ray from a very capable man. It was my intention to state what a pleasure it has been for me to have a machine installed in my office and right off the bat I am going to point the finger at every one and say, that it surely is a necessity and I can prove it. You will say you can send out for all that you want, but I want to say I do not believe there is a solitary man practicing orthodontia that has used the rays as much as he should, when he did not have one in his own office. I just want to cite one case where I failed under these circumstances through no fault of my own. The patient was a lad and there was no reason to suspect that any of his permanent teeth would be missing; and, as in hundreds of cases, I never even thought of using the x-ray. The jaws were expanded and retention placed. At the age of twelve, the boy returned to our city having in the meantime moved three hundred miles away, and no orthodontist within a hundred miles, and I found that a week prior to returning he had lost his second lower deciduous molars. Having a "new toy" I proceeded to look him over and to my chagrin I found no bicuspids following. Here is the situation: The boy is condemned either to wear a bridge all his days or until he later loses his abutments and then more trouble, which in our present light is not good practice, or he has to have his molars brought forward. The case could have been finished had I known "the knowable" in the best manner, at the proper time, and when the going was good. Right here I want to go on record and state that I believe if we are so ideal as we are "dubbed" by our friends we can not possibly render the best service without first knowing if all the permanent teeth are on the way, and there is only one way of finding out, and that by means of the x-ray. Therefore, it is up to us to know by getting a picture of the whole mouth before we can make even a good diagnosis to say nothing of the prognosis.

After sixteen years of real experience I have arrived at some very definite conclusions:

In the first place I would never say just how long or short a time a case may require in treatment. Your guess may be as good as a twenty to one shot. Personally, I have lost one of my earliest attainments.

That because one operator gets results with one kind of an appliance it does not follow you can do so with the same appliance.

That the metal materials we use in our appliances are of a very great importance and that we can not use just any old thing and get results, and that "substitutes" are very often inferior and give absolutely bad results.

That it is wise not to overpromise. One's enthusiasm may get him into trouble.

That it is just as wise to drop an incorrigible patient as it is to cut off, in the business world, a "dead beat."

That the closer I observe the diameters of teeth the more I am convinced that the teeth are not nearly so symmetrical and harmonious as I once thought them to be.

That in a busy practice one does not always go into the etiology of every case but that Mr. Etiology is just naturally forced on us when we get up against the real thing.

That the points picked up in our annual meetings (the real clearing house), are the real helps to carry us over the top for the oncoming year.

That our most appreciative patients are not the very rich.

That it is not good to take life too seriously, not even orthodontia, and that if patients will not conform their wills to yours it were better for both if relationship should cease.

That one ought to run his office and not let his office run him. I must add that this is an annual resolve with me, but being a Methodist I prove a good backslider.

That you can not please all your patients although I know of no calling where such a wonderful percentage will go the limit in singing your praises.

That arches that are "seemingly" retained the least, actually have occlusion established the best.

That it is not necessary to cut and cauterize nearly so many so-called frenums, as we were wont to do fifteen years ago.

That expansion of arches many times will free the postnasal space of growths without any operation.

That the annual visit to our meetings is just as necessary to our orthodontic growth as eating our daily meals is to our physical growth.

That the x-ray is not a luxury but a necessity in the practice of every orthodontist.

That if you really want to work for a patient take time to fully explain the possibilities of the operation and that this is really worth while for the impression it makes.

That a photograph taken before may save you from some charge that you have done this or that to some fastidious mother's daughter.

That with most people it is business to write a confirmatory letter to your verbal conversation as to what you propose to do and what is expected on their part. Parents sometimes die.

That when writing letters to other men referring patients you had better not state anything you would not wish the patients to see. If you must send any private information better enclose same on a separate sheet. Embarrassment may be thus saved.

That some cases are handled easily by some operators which prove troublesome to others.

That you can not work for every one who presents himself, and should be grateful when many can not go along.

That we get into ruts, especially in the line of treatment in our cases, and without really thinking, we are going through the same procedure when if we would but stop and think, another line would be much more preferable.

That we only learn by our failures, and that we have enough obstacles to keep the cobwebs from forming in any great numbers.

That children will soon discover if they have a "crab" or a friend, as an operator. Better be kind.

That there is real truth in that a man should have a hobby, and personally I am sorry I did not take up the king of outdoor sports sooner. In one respect I differ from a man who wanted to get into the army over in England, and the physicians all said he was suffering from an incurable disease and could not be helped. He said he was born too soon.

That you have to get a "real bug" if you are to amount to anything.

That it pays from every angle to have a well-equipped office.

That we ought to get lots of fun out of our work.

That it pays to have a good assistant.

That all work and no play makes for cranks, and that an orthodontist must keep young by keeping sweet.

That we do not use psychology nearly as much as we should.

That what we know today may be obsolete tomorrow, and that the man who is not a student is scheduled for the skids.

That at different times we have so much efficiency that it interferes with real work.

That it requires skill and experience to know how to handle mutilated cases.

That different operators have different conceptions as to what constitutes a normal arch form.

That it is worth while to have an open receptive mind to truth as it comes from different sources.

That good work is cheap at any price and that poor work is dear even if it costs nothing.

I want to personally and publicly thank the Chairman of the Board of Censors, Doctor Ralph Waldron, for his effort of this year. Had I not had explicit confidence in him, I certainly would have been worse than the proverbial hot cake on a griddle, for I did not know what he had on his pro-

gram until the last month. Also at this session I should like to have the society send greetings to Doctor Guy Hume, the one who would have been the Chairman of the Board of Censors, had he not enlisted with the Canadians at the beginning of the war. Doctor Hume has not had even a furlough and I have no doubt but that when he returns he will be able to bring back a very rich experience that will be helpful to us all.

I would furthermore like to entertain a motion at the proper time that those of our number who have enlisted in the service should have their dues remitted.

I would furthermore pass a compliment on to the great national body on their stand in that they have at last given orthodontia some recognition by creating a section for our specialty in conjunction with the periodontists. I trust that this society will lend an ever willing hand, and that the Journal of the National Dental Association will have representative articles on our specialty.

I would furthermore like to recommend in conformity with the national and many state societies that the first vice-president be installed the president-elect.

And now lest you might think I am a base ingrate I could not close without thanking you for this great honor you have conferred upon me in permitting me to preside over this body of as intelligent men in their own line as assemble in any convention.

Some one has said they do not care what you say, just so you make it short, and this reminds me of the story they tell on a Frenchman who was at a banquet in New York. The evening had worn on until a late hour and just after an Englishman had taken his seat this Frenchman was called upon. He began thus: " I do not wish to further cock-roach on your time as the hour is late." The audience started to twitter, then to laugh out, so much so that he could not proceed, so he turned to his English friend and said, "Did I say anything wrong?" The Englishman replied, "You certainly did. You said cock-roach when you should have said hen-roach." So I shall not further encroach on your time, as I years ago learned to multiply the number of members present by the number of "hot air" minutes that were consumed, and the lesson has never just quite got away. I would prefer much to be like our good friend Lourie, when he does open his mouth he says something worth while, and it is always brief.

I will close with just two quotations. The first, "It is only while we're green that we grow, and when we think we're ripe, we've begun to get rotten." And the second, "Could'st thou in vision see thyself the man God meant, thou never more would'st be the man thou art, Content."

DISCUSSION

Dr. Frederick C. Kemple.—Mr. President, Members of the American Society of Orthodontists, and Guests: I wish to compliment Doctor Flint on the excellence of his humorous address. At the same time, I wish to disillusion him by informing him that his paper, like all other papers, becomes the property of the society immediately upon being read before this body, and that he has not the privilege of revising it or editing it, in any way, after it has been presented here. He spoke about changing it, and cutting out. The Board of Censors will see that his paper is published as read in accordance

with the rules of the society. But seriously, the essayist has expressed many very true and very important thoughts, and has made, I believe, some excellent recommendations, one of which is in regard to the proposed changes in the Constitution and By-Laws. I happened to be a member of the committee that drafted the original Constitution and By-Laws for this society. It was the purpose of that committee and I believe it has been the purpose of the society from its inception to be as broad and liberal-minded in regard to the admission of new members as possible, observing at the same time the importance of conserving the time of the members who travel great distances to attend these meetings.

I regard it as the professional duty of every orthodontist and of every society of orthodontists, to aid the general practitioner in obtaining a practical working knowledge of orthodontia, and to give freely to any other orthodontist any information he may have concerning methods of treatment, etc., that may in any way be a benefit to the patients of the practitioner seeking the information. In other words, it is our professional duty to help any man, engaged in the practice of orthodontia, to do his work in the best way possible. That is the true professional spirit, and that is what this society is trying to do by inviting members of the profession at large to attend these meetings.

The sooner we realize that the specialists in orthodontia in this country can not possibly take care of even a small fraction of the cases that require treatment, the better it will be for us, and the better it will be for the profession at large.

Doctor Flint referred to a paper which I read in Pittsburgh, and in which I spoke of the possible effect that bands might have on the teeth. Some of our members misunderstood what I meant to convey at that time. I meant this: there has never been an investigation of the possible structural changes that may take place throughout the body of the tooth that may have been caused by this tooth having had a band on it for a prolonged period. I did not mean possible caries; I did not mean the decalcification of enamel; but I meant that it would be a good idea for some of our members, who are inclined towards research work, to place bands on some of the teeth of young animals, leave these bands on for a given period, and examine histologically the structure of these teeth, and compare it histologically with the structure of the corresponding teeth in the same mouth that did not have the bands on them. I think it is perfectly possible there might be some structural change in these teeth due to wearing bands for a prolonged period.

The essayist also referred to opening spaces and replacing missing teeth by bridgework, on the old theory that you *must* have thirty-two teeth in the mouth and there *must* be ideal occlusion. Any man who has practiced orthodontia many years certainly has discarded the idea of *always* getting ideal occlusion. As the president has said in his address, he must have come to realize that there is not the symmetry and harmony in structure and tooth material in the human denture that he had previously been led to believe there was. You can not get ideal occlusion and keep it in any mouth where the amount of tooth material in the upper dental arch does not harmonize with the amount of tooth material in the lower, and where the arrangement of the cusps and sulci does not harmonize. And when it comes to the question of replacing missing teeth, I would infinitely rather a patient or a child of mine had a tooth missing, and had the space completely or partly closed than to start the child into life with an artificial substitute of any kind, whether it is a tooth on a plate, or whether it is a bridged tooth. When we cling to an ideal we very often lose our sense of relative values; we lose the common sense view of it. It is very important to give each child as nearly a perfect occlusion as we can, with due regard to other factors that should command consideration.

The essayist also spoke about the practice of cauterizing frenums. Ten or twelve years ago I cauterized a great number of frenums. I do not suppose I have cauterized a frenum in the last five or six years. In many of the frenums cauterized I believe the space between the central incisors was more difficult to close because of the scar tissue. I have seen many cases where the spaces between centrals have fully closed of themselves without any interference on the part of the orthodontist. In these cases, if there was a frenum there it was resorbed, and I believe in almost every case that the tissue will resorb if the teeth are brought together and held a sufficient length of time.

I want to thank the essayist for the many wise, as well as the witty, thoughts he has injected into his address.

Doctor R. Ottolengui.—Mr. President and Gentlemen: Just at the close of the reading of the president's address, a gentleman behind me said, "That is the best president's address I have ever heard delivered before this society." I think he forgot I wrote one of them myself. (Laughter.) But so speaking for myself, and not for the other presidents who have written addresses, I endorse the gentleman's opinion. The most attractive

part of the paper I think is to be found in the epigrammatic statement that was made and which the essayist said was put forward tentatively. I agree with Doctor Kemple that we can not afford to lose anything of what Doctor Flint has said. We can not let him take anything of this out. He might perhaps spend another half day on his address and polish it up a little, but he can scarcely improve the subject matter.

He said that the best thought in his paper was where he expressed the belief that we do not use enough psychology. I think that is a good thought, Mr. President. To me the pearl of the entire address is in the following language, because on it lies the important philosophy of our art, namely, "Arches that are seemingly retained the least, actually have occlusion established the best." We might pause for a moment to let that sink in.

I differ with the president where he advises us to write to the attending dentist on a separate piece of paper. My recommendation is to telephone him. (Laughter.)

I would like to say a word about the excision of frenums. Of course, only being partially engaged in the practice of orthodontia, I do not see as many cases as the exclusive specialist, but at the same time I have been practicing a great many years longer than some of those present, yet I have never cut out a frenum, nor have I ever treated a case of the kind where I regretted afterwards that it had not been cut out. Doctor Kemple said, it will probably be tried in many cases and that it will be more difficult to close the space after cutting out the frenum and allowing the cicatricial tissue to supervene. But I do not think, Doctor Kemple, that would be the best method of procedure if one really plans to cut out the frenum. A middle ground is a better course to take in treating the case, without excision of the frenum. Bring the parts together either by compression or by actual resorption. If you have resorption and the parts can be held together long enough, you will not need a surgical operation. If you have only compression, and there is persistent ligamentous tissue present, you may test the matter by removing the appliance and observing the rapidity with which the parts separate. If you are then satisfied that excision is the right course to pursue, it should be done in my opinion at that time, and your original regulating appliance replaced immediately afterwards, the teeth forcibly brought together, and healing allowed to take place.

I want to say a word now about another important matter, and that is about bands and crowns. The essayist says he has made a slight investigation of the matter by asking dentists who remove crowns from teeth to report on the condition in which they find such teeth. I would like to call attention to the fact, Mr. President, that that is a totally different condition because a crown has a top to it, whereas a band is open at both ends, both at the occlusal end and gingival border, which makes a great difference. Where cement has completely covered the opening and the band goes under the gum, the tooth can be protected from caries. The point made by Doctor Kemple is an important one; where he speaks of placing bands on some of the teeth of young animals and after leaving them on for a given period to examine histologically the structure of these teeth and compare with the structure of the corresponding teeth in the same mouth that did not have bands. I do not think, Doctor Kemple, you need go to the lower animal, because we can duplicate in a sense the work we did in cooperation with Dr. Grieves. We could band temporary molars and keep these bands on, and at the time of their shedding, these teeth could be removed with the band and sent to the man who undertakes the histologic work for us for examination, and it would be especially interesting if we had bands on temporary molars in one part of the mouth and not another, and sending a complete set of teeth to see whether there is any difference.

In conclusion, I wish to say that if it were possible some parts of this paper be published in gold ink. (Applause.)

Doctor George F. Burke.—I would like to add a word relative to the treatment of the frenum. There is apparently much difference of opinion relative to the wisdom of operating on it. Some operators do not believe in it, and it would be a valuable help to many men in the practice of orthodontia, if they had a better understanding of its proper treatment. I would therefore urge that the Board of Censors have presented a paper by one competent to treat this subject in its broad aspects at the annual meeting of this society.

Doctor D. Willard Flint.—To "help the general practitioner" appeals to me as a very good slogan. We have all been doing it, but as a solution to part of our troubles we ought to go out of the way to do this very charitable thing.

THE HISTORY OF ORTHODONTIA

(*Continued from page 476.*)

By Bernhard Wolf Weinberger, D.D.S., New York City

GEORGE GAILLARD, *Des deviations des arcades dentaires et de leur traitement rationnel,* 1879. This work of some two hundred pages, with eighty illustrations, was devoted to irregularities of the teeth. Gaillard first reviewed in a short historical resume those books in French that he was able to obtain. The first part he then devoted to the evolution and development of the teeth, the second to anomalies in position of the teeth and the third part to treatment of irregularities of the teeth.

Not satisfied with the classification of Magitot's, Gaillard proposed the following six divisions, according to the position of the teeth:

1. Heterotopie.
2. Anteversion.
3. Retroversion.
4. Lateriversion.
5. Rotation.
6. Emergence.

In the treatment of cases under 2, 3, 4, 5, Gaillard arranged his appliances to work in the following manner:

Anteversion	a pressure posterior. a traction anterior.
Retroversion	a pressure anterior. a traction posterior.
Rotation	a pressure double or single. a traction double or single.

He used one type of appliance for all cases, this consisted of caps or crowns of platinum joined together by a platinum bar. The crowns were generally placed on the first molars and bicuspids. To these a platinum wire was soldered extending from left to right across the buccal and labial surfaces. To this arch wire, opposite each tooth, were soldered, small rings of platinum wire. (Fig. 1.) Silver wires were drawn through small triangular openings (Fig. 2, *c*) on the buccal surface of the appliance. These wires held the apparatus in place. As the metal rings rested against the teeth, they acted as a fulcrum, rubber bands being used to draw the teeth to the arch. (Fig. 3.)

The success in using this appliance is shown by nineteen recorded observations, all differing in the type of case, with illustrations prior to and after treatment.

M. J. Museler, in the October number of the *Correspondenz Blatt für Zahnarzte,* 1881, presented a new method of correcting the protrusion of the mandible. Figs. 4 and 5 illustrate the type of appliance that was used. Both are of vulcanite and were applied to the mandible. After Fig. 4 had been used for several days, Fig. 5 was applied, by turning the screws the lower teeth were forced backward until they articulated within the uppers.

G. L. Simpson on *Irregularities, Ohio State Journal of Dental Science,* page 512, 1882, before the Odontological Society of Western Pennsylvania, said:

"I made a plate of vulcanite, with gold clasps around the two first bicuspids, then allowing the rubber to extend up over the second bicuspids and molars. This served as a gag, and at the same time made mastication possible. The plate just back of the incisors was made thicker than usual to admit of

Fig. 1.—Platinum "caps or crowns" with "platinum bar." Occlusal view. (George Gaillard.)

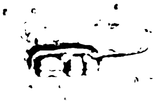

Fig. 2.—Side view of same appliance. (George Gaillard.)

Fig. 3.—Front view of same appliance. (George Gaillard.)

Fig. 4.—Museler's appliance of vulcanite to correct the protrusion of the mandible.

Fig. 5.—Another appliance, illustrating the use of the screw. (M. J. Museler.)

holes being drilled. Into these holes every third day I placed a piece of dry burnished wood. One tooth requiring a little rotating, against this tooth I placed two pieces of wood, one longer than the other. This worked so well that in six weeks' time I removed the blockade from between the teeth, and in four weeks more I removed the plate, leaving the teeth to the care of articulation, which, thanks be to it, has performed its part well. Although I used a rubber plate in this case, and have done so in other cases, yet contrary to the general practice, I prefer to use a swaged silver plate; it being thinner is less objectionable to the patient, and in my experience is every way preferable. With a blowpipe attached to the foot bellows, it is but little trouble to make any desired change. If you wish a loop through which to pass a ligature, a hook for a rubber band, or a shoulder for a bolt and nut, all can be completed in a few minutes and at any time. In a number of cases of very prominent cuspids, where the six-year molars were badly decayed, I extracted them. The second molars being very short, could not assist in bringing the erring cuspids to place, so I

used a silver plate with four loops, so placed that when the ligatures were thrown around the cuspids and first bicuspids, they had the effect of holding the plate in position, and, at the same time, drawing the bicuspids back and drawing the cuspids backward and inward. It will sometimes be necessary to place a wire or ledge opposite the teeth around which the ligatures are to be placed to prevent them from impinging upon the gums. I use for ligatures spool embroidering silk, E or EE. I use ligatures in every case where it is possible, preferring them to rubber bands, or even bolts and nuts. Teeth standing inside of the arch can be (if there is space sufficient) readily brought to place by the use of a band around the labial and buccal surfaces of the teeth, and for this purpose I use 10-karat gold wire.

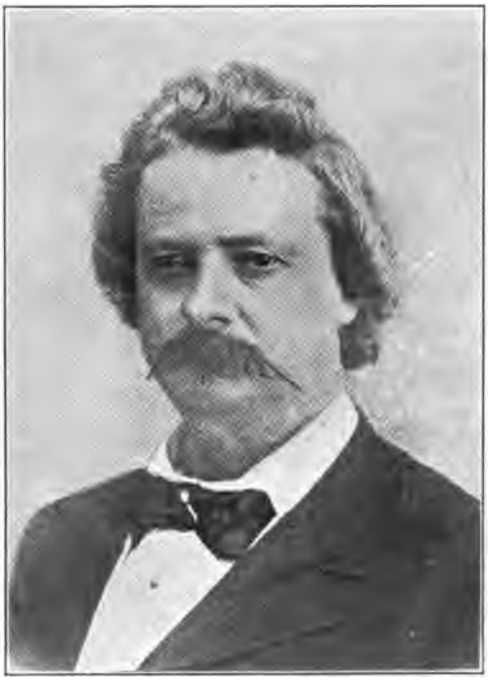

Fig. 6.—J. J. R. Patrick. (1828-1890.)

"To each end of this wire solder a piece of flat gold or silver. By punching holes through these the band can be made fast to either the bicuspids or molars with light platinum wire or gold bands and nuts. Then draw the teeth out to position with a waxed ligature. My reason for using 10-karat gold wire is that it is stiff and strong even when very light, answering every purpose, and its appearance is less objectionable than that presented by a flat band of 20-carat gold.

"With a little care in forming this band, teeth can often be rotated very nicely with the ligature. For more difficult cases, take a thin ribbon of platinum and form this around the tooth to be rotated, allowing both ends to extend out some distance side by side, then double back on itself, solder this, flowing the gold all over the outside of the band, then you have a band with a

handle to it. Drill a hole through the point of this lever, and, with a ligature, you can turn any tooth that you might wish; but great care must be exercised not to do the work too rapidly."

At the twenty-second annual session of the American Dental Association, 1882, papers were read by W. N. Morrison, W. H. Alkinson, E. T. Darby and others. Nothing new or important was brought forth, although all contended that their method was *the* method for regulating.

J. J. R. Patrick (1828-95), in 1882, before the Illinois State Dental Society, described his new and novel method of aligning the teeth in either arch. This appliance, seen in Fig. 7, consisted of "a half-round gold and platinum bar (*A,A*), curved to correspond with the shape of the arch, having upon it a number of sliding rings, by means of which anchorage is secured and attachment made to the teeth to be moved. The bar is bent with its flat surface inward, and is of sufficient length to allow its ends to rest gently on the external lateral surfaces of the first or second molars as desired. The slides are fitted accurately, so as to move steadily. Two of these, which are made longer for the purpose, are used to secure anchorage, by soldering to their inner surfaces thin gold bands

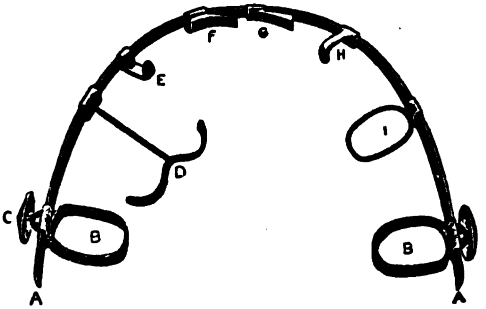

Fig. 7.—Patrick's appliance with bands, arches, and sliding attachments.

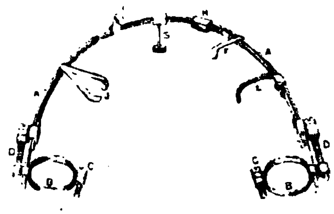

Fig. 8.—Screw clamp band substituted for set screws and plain bands.

(*B,B*), previously fitted to the teeth selected. The bar is held in position by set screws (*C,C*), passing through them. Small buttons are soldered to their external surfaces, through which the screws pass to give them greater purchase. To the smaller slides the different appliances for moving teeth are attached, as wedges, hooks, T-bars, loops, and bands (*D,E,F,G,H,I*), of various sizes and shapes as required. The mode of operation is very simple. The apparatus acts as a lever, of which the power is the elasticity of the bow-spring, the fulcrums the points used for anchorage, and the resistance the tooth or teeth to be moved. If these are outside the arch, the bow-spring is adjusted so that its flat surface touches all of the projecting teeth, and is firmly set with the set-screws. The wedges are then forced together between the teeth to be moved and the bar; should the wedges cease to act before the teeth are properly placed, the set-screws are loosened, the wedges separated, and the bar taken up until its inner surface is again pressed against the projecting teeth, when it is again set firmly, and the wedges are again brought into play. To move teeth outward, the elasticity of the bow-spring is made to draw upon them by means of the proper appliance. Rubber bands or ligatures may be made useful auxiliaries.

This appliance can be used on either jaw. Should the bar at any time exhibit a tendency to slip toward the gum, it can be held in its proper place by snapping one of the slides provided with a hook over the cutting edge of a tooth."

As will be seen, this mechanism comprises nearly all of the valuable features that are to be found in our present-day "expansion arches."

In 1887 Patrick substituted screw clamp bands for the plain anchor bands with set screws as shown in Fig. 8.

W. R. Humby (*Dental Record,* London, 1882, page 49) describes *A New Method of Regulating the Incisor Teeth.*

"I first applied the rubber dam to the four incisors, then carefully cleaned them and dried them with an air syringe, and applied a layer of ether copal varnish. I then wound round each central a strand of silk, and tied it in a knot at the distal (or what should have been the distal) surface, leaving the ends of the ligatures free, as shown in Fig. 9. I then included in the silk of the one side a strip of the white vulcanized rubber dam in use in the hospital (the rubber was about a quarter of an inch wide and of the stoutest variety), and stretched the free end of rubber until the traction seemed to me strong enough

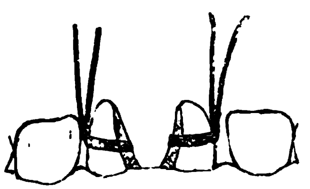

Fig. 9.—Method of regulating the incisor teeth. (W. R. Humby.)

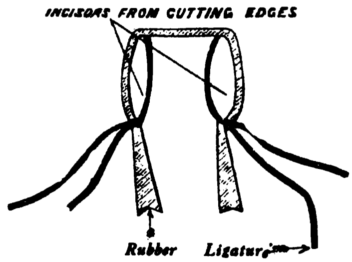

Fig. 10.—Side view of Fig. 9. (W. R. Humby.)

Fig. 11.—Occlusal view of Fig. 9. (W. R. Humby.)

for the purpose. I then included it by tying in the second ligature thus (Fig. 10). I now varnished the silk, especially the knots, cut off the surplus rubber and silk, removed the protecting rubber dam, and requested the patient to see me in a week. He came, according to appointment, and I was quite delighted with the progress made—the teeth met in the median line, and the only thing remaining to be done was to increase the torsion, as the teeth, viewed on their cutting edges, had a slightly gothic archlike expression. I lifted the first strip of rubber and inserted beneath it a small pad of the same material, and tied this to the first. (Fig. 11.)

Henry C. Quinby, *Notes on Dental Practice,* 1883. in his chapter *Irregularities,* says:

"The appliances necessary for operations of this nature have to be worn constantly, day and night, at meal times and play time. They are sometimes so secured in the mouth that they can not be taken out by the patient, but usually they can be removed for cleansing night and morning, and this is all the indulgence that can be permitted. They are often so constructed that bands or springs of gold or platinum are conspicuously visible in the front of the mouth, and children wearing them have to make up their minds to give up parties for the time,

or stand a little chaffing from their young friends, for they can not have the plates out of their mouths for an evening's amusement.

"Screws and springs, fixed in a vulcanite frame, as the case may require, will move any number of teeth to any necessary extent, even when, as the following case will show, the patient is considerably beyond the age at which these operations are usually undertaken."

One appliance is shown in Fig. 12 and illustrates the apparatus for moving misplaced canines. Fig. 13 shows the "form of plate to take pressure off the back teeth, so as to allow them to elongate."

In another case Quinby reports, he says:

"The next step was to move the bicuspids back, which was done by making a vulcanite plate to cover the upper molars, in order to take the bite of the lower teeth on the molars and the incisors, leaving the bicuspids so that the lower teeth could not touch them. A fixed nut was placed in the substance of the vulcanite opposite the buccal surface of the molar on each side. Then a

Fig. 12.—Showing apparatus for moving misplaced canine. (H. C. Quinby.)

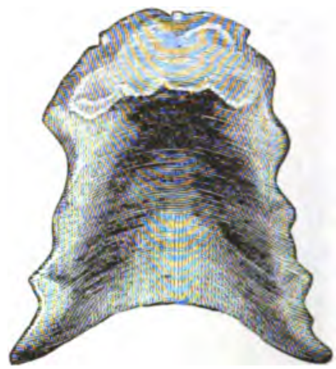

Fig. 13.—Showing form of plate to take pressure off the back teeth, so as to allow them to elongate. (H. C. Quinby.)

narrow strip of very thin gold, shaped like a figure eight, was made to fit tightly over the bicuspids on each side, and a piece, shaped like a letter **T**, was soldered to the band, so that it would slip between the two teeth and the cross lie in the sulci, to prevent the band slipping too high up under the gum. A small ring, or rather a stud with a hole in it, corresponding to the size of the screw hole in the fixed nut, was also soldered to the band opposite the buccal surface of the second bicuspid. The apparatus was then placed in position, and a long screw, with a square head, was passed through the stud into the fixed nut, and screwed up. A key fitting the head of the screw was then given to the father of the young lady, with instructions to turn the screw every day as much as she could bear, and to see that the gums and teeth were sponged twice a day with a weak solution of carbolic acid, letting me see the case once a week, to take the plate off and clean it thoroughly. This treatment soon moved the bicuspids back. (Fig. 14.)

"The plate for moving the front teeth was fitted over the molars and bicuspids. The fixed nut was placed opposite the first bicuspid and, of course,

the plate had to be kept well back in the palate, allowing fully half an inch between its anterior edge and the lingual necks of the front teeth. A long strip of thin gold was cut in the shape of (Fig. 15), the lips being intended to be bent over the cutting edge of the central incisors to keep the band from slipping up on to the gum, and studs were soldered to the ends for the screws to pass through. The canines being always rather difficult teeth to move, I made a separate loop for each of them (Fig. 16) having holes through the ends, which were bent so that the holes would come opposite the holes in the studs at the ends of the long strip that went around the front teeth, allowing the screw to pass through both ends of the loop, as well as through the stud. (Fig. 17.) This soon forced all the teeth back to the required position. Another plate, with a plain band fixed in the vulcanite, passing around the front or labial sur-

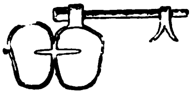

Fig. 14.—Showing the form of band and screw used in moving the bicuspids. The nut was fixed in the vulcanite plate. (H. C. Quinby.)

Fig. 15.—Showing the form of the strip of gold that was used for moving the front teeth. (H. C. Quinby.)

Fig 16.—Showing the form of loop used for the canines. (H. C. Quinby.)

Fig. 17.—Showing the regulating apparatus in position, with the loops for canines omitted. (H. C. Quinby.)

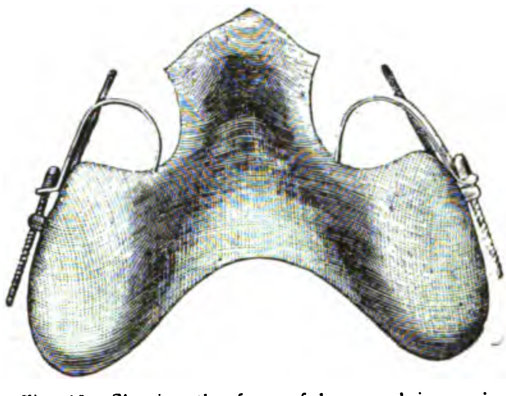

Fig. 18.—Showing the form of loop used in moving the canines. The straight bar projecting from the buccal surface of the plate is intended to prevent any outward movement of the teeth. (H. C. Quinby.)

face of all the teeth, with hooks, as before, bent over the cutting edge of the central incisors, to keep it from slipping, kept all these teeth in position until the alveoli were properly formed and the teeth quite firm in their new position."

Fig. 18 of Quinby's shows "the form of loop used in moving the canines. The straight bar projecting from the buccal surface of the plate is intended to prevent any outward movement of the teeth."

Fig. 19 illustrates a retaining plate in position.

Quinby also made use of the jackscrew as shown in Fig. 20, showing form of braces to be used in widening the upper jaw in connection with Fig. 21.

William H. Trueman, before the Pennsylvania State Dental Society, 1883, (*Independent Practitioner,* page 521) being impressed with the value of the screw, read the following paper: *The Use of the Screw in Regulating Teeth.*

"First, the advantage of the screw. It is positive motion; if it is moved one-quarter of a turn the tooth must move a corresponding distance, for it is not dependent upon any action on the part of the patient. It is an unyielding motion; the tooth is moved and held firmly in its new position, and is not disturbed again for hours. That is the secret of its painlessness. It is not like a spring, that, when it has moved the tooth, allows some other force to move it back, and thus by a to and fro motion sets up severe irritation. It holds the tooth so firmly that in the most severe cases of interlocking there is no need of capping any of the teeth to keep the jaws apart. It works so rapidly that no injury need be feared from loss of antagonism while the tooth to be moved is taking its new position.

"As each case requires its own special appliances, I can only give an outline of the manner in which the screw is fixed in position.

"We first fit a band around the tooth to be moved, generally making it of

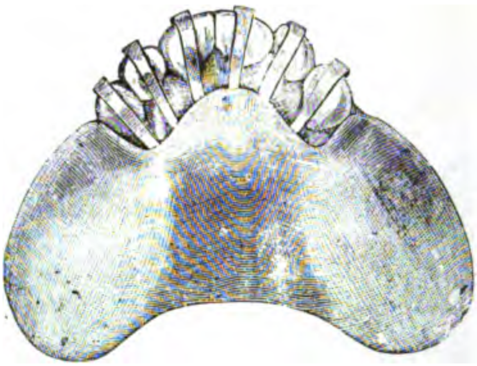

Fig. 19.—Retaining plate in position. (H. C. Quinby.)

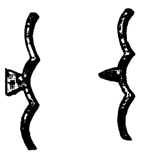

Fig. 20.—Showing form of braces to be used in widening the upper jaw in connection with the jackscrew. (H. C. Quinby.)

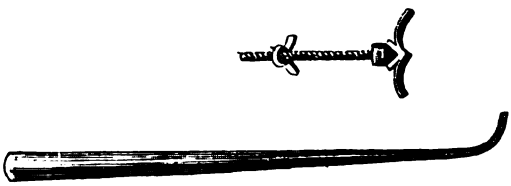

Fig. 21.—Showing another form of screw to be used in widening the upper arch, with the lever for turning the screw. (H. C. Quinby.)

platina-gold, as with it we obtain the greatest strength with the least bulk. If for one of the front teeth, we make it narrow, fitting it well down on the neck of the tooth, making it spring on tight, so that it can not possibly slip over the crown. In putting it on, it is not, however, slipped over the crown, but pushed through the little space always found at the necks of the teeth, from the inside of the mouth. It is well to let the ends come well through, and to make them pointed, so that when in place they may be tightened with pliers, as were the old-fashioned narrow bands on plates.

"The bands fitted, we solder to each, with silver solder, a tongue of heavy silver plate to support the screw, and while soldering it to the front band extend a tongue to rest upon the palatine surface of the tooth, so that the band shall

not press into the gum too hard. These tongues should not conform to the roof of the mouth, but be made straight, otherwise when the tooth moves they will be pressed into the gum.

"We are now ready to attach the screw. First enlarge the holes in the bar to at least double their size, so as to admit an instrument strong enough to turn it when in the mouth. Now file the nickel-plating from both nuts, and so shape them that they will fit on the silver tongues snugly and present no sharp edges to the tongue, and then thoroughly coat them with tin, and also tin the lingual surfaces of the silver tongues. Now place the bands in position on the cast, lay the screw with the nuts in position, screwed up nearly as far as they will go, and holding them in place, if needful, with a little plaster, thoroughly unite the silver tongues and nuts with soft solder; use it freely and be sure it

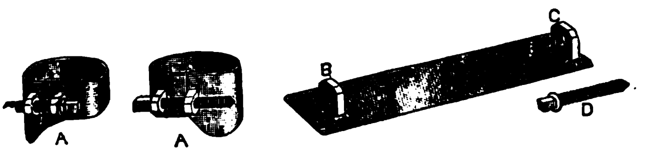

Fig. 22.—Phosphor bronze band matrix with screw. (J. A. Woodward, 1885.)

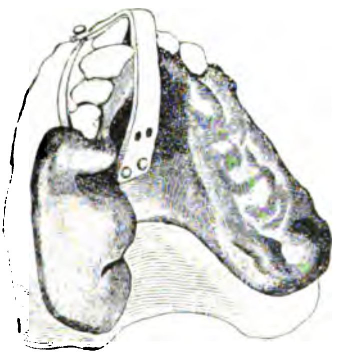

Fig. 23.—Vulcanite plate. (Carl Kühns, 1885.)

Fig. 24.—Vulcanite plate, with an anterior attachment. (Carl Kühns, 1885.)

takes hold well to avoid after trouble. The fixture is now complete. Before putting it in place oil the nuts and screw well; the surplus may be wiped off, but be sure there is plenty between the nut and the screw, or after a few days it will be impossible to turn them. It is often difficult to fix it secure enough to resist the force needed to turn the screw, and it is generally best to support it with the fingers, and to examine closely to see that it is not displaced before dismissing the patient. In screwing up turn gently and slowly and stop for a few moments if it goes hard; each time screw up as far as the patient can bear, and then from $\frac{1}{8}$ to $\frac{1}{4}$ of a turn more. The pain will cease in a few moments. It is best to go too slow rather than too fast, but that and many other little things are matters for the operator's judgment."

J. A. Woodward. In reviewing the literature how often we come across an appliance used at the time for an entirely different purpose, meant to be foreign to that branch of dentistry, becoming obsolete as far as the original purpose is concerned and in time found to be incorporated in our science. Such an example is found in Fig. 22, *Dental Cosmos,* 1885, and undoubtedly is the predecessor of our overlapping clamp bands. J. A. Woodward introduced it as a band matrix. It was made of phosphor bronze. No. 30 gauge and strip in form, bent to overlap around the tooth one-sixteenth of an inch. The screw was of steel (*d*) and fitted into a post made of piano-wire, (*b*) threaded and set back about one-eighth of an inch and soldered to the strip with silver solder. The post in which the screw turns freely is set near the other end (*c*).

Fig. 25.—George W. Keely. (1822-1888.)

Carl Kühns in the *Deutsche Monatschrift Für Zahnheilkunde,* 1885, introduced in his treatment of irregularities of the teeth several additions to the vulcanite plate as seen in Figs. 23 and 24. There was little new, however, in his method of correcting irregularities.

George W. Keely (1822-88). In 1882 Keely began to contribute in the *Ohio State Journal of Dental Science* a series of orthodontic articles under the title of *Regulating Teeth—A Case in Practice.* He favored the vulcanized rubber appliance, making use of ligatures, elastics, wooden wedges and the jackscrew in order to bring about the desired results. Some of his methods are as follows:

Ohio State Journal of Dental Science, 1885, page 37:

"A vulcanized plate was fitted to the roof of the mouth, with a brace around the second right molar, and one in a gap between the first and second molars, on the left, for the purpose of retaining the apparatus firmly in place. A strong ligature was cut from rubber tubing, put over the erupting cuspid, and carried back and attached to a button made on the plate, opposite the buccal portion of right molar. (Fig. 26.) As the removal of the bicuspid left such a large opening just where we wanted the cuspid, fears were entertained that it would be drawn back too quickly, but in this we were mistaken. A ligature was also placed on the first molar, and carried to the cuspid, for a double purpose, as we wished to draw the molar forward to help fill up the gap, and make it antagonize with the lower one.

"It required nearly three months to draw the cuspid back where its point could pass out between the cusps of the inferior bicuspids.

"At this time it was our purpose to make a new plate and adjust a jackscrew, which was not admissible before, for want of space to operate it. The

Fig. 26.—Method of correcting a misplaced cuspid. (George W. Keely.)

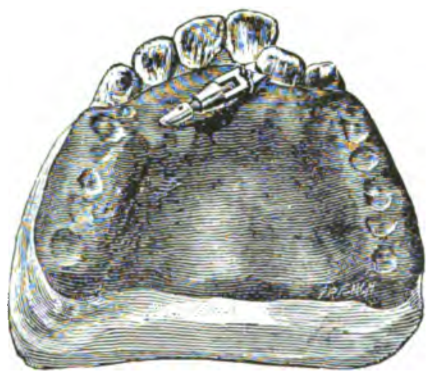

Fig. 27.—Vulcanite plate with jackscrew. (George W. Keely.)

apparatus was removed and for a temporary purpose, (as my time was limited), a bar was cut from a piece of compressed pine, beveled in the centre, and placed firmly against the left bicuspid, and pressed firmly down to the margin of the gum.

"A retaining plate of black vulcanite, with a bicuspid tooth to fill the remaining gap, was adjusted, fitting very firmly to the cuspid, forcing it out still further, and it is still worn with comfort."

Ohio State Journal of Dental Science, 1886, page 107:

"On the right side the plate is made thick to receive the end of the screw, a small hole being drilled for that purpose. The point of screw placed as seen in the cut, to move it out of the lock in the easiest possible way, and also to give it a slight turn in its socket. (Fig. 27.) The point of a small broken drill was used to operate the screw. When the apparatus was properly adjusted, and the screw in place and tied with a thread to the plate as seen near the refractory tooth (this is done to prevent the loss of the screw as it is not a digestible substance), the screw is tightened two or three times a day, every time the patient

insisting on vigorous work. The apparatus was removed every day and cleansed, and the patient was required to give his teeth a thorough brushing.

"As the tooth moved to its normal position it disturbed, to some extent, both the central and cuspid. At the end of the ninth day it was in place, and the apparatus was removed, and a retaining plate inserted and worn about ten days. In this case a retaining plate was not absolutely necessary, and was inserted only to hold it until the central and cuspid would fall back into place."

(Page 250) "Recently an eight-year-old boy came to me, his temporary centrals were in place, the right permanent central was caught about one-sixteenth of an inch—the left one just appearing. We removed the temporary centrals and gave him a stick of wedgewood, flattened at each end, to use as an incline to press on the left erupting tooth.

"A perfect impression and model were taken, a trial plate fitted over the roof of the mouth and posterior teeth, a bite taken to raise the teeth so the offending centrals would swing clear when moved to their normal position, and the patient

Fig. 28.—Vulcanite plate with pins of pine wood. (George W. Keely.)

have a masticating surface on the plate. Holes were drilled in the plate opposite the centrals, the plate reaching up to the cutting edges of the teeth. Sea tangle tent was first used to start them, then pins made from well-seasoned pine. The plate was removed daily and cleansed, and new pins adjusted." (Fig. 28.)

(Page 345) "Both arches were unusually well developed; the teeth strong and firm, all the posterior ones antagonized perfectly; all the inferior ones being in perfect line. The deformity appeared in the prominence of the six superior anterior teeth. Thumb-sucking was indicated as the cause of this unusual prominence, but I was assured by the mother that she had never been addicted to this prolific cause of such deformity. Unfortunately, she had a short upper lip, and in conversation she would expose the six anterior teeth, and the fourth of an inch of her gum, and could not use her upper lip in articulating words. She could cover these teeth only by drawing her lip down with her fingers. From the cutting edge of the superior incisors to the inferior, it was just one-half inch, one-fourth from the laterals, and one-eighth from the cuspids.

"In this case the extraction of the first superior bicuspids was absolutely indicated, to make the necessary space to draw the cuspids back, and the incisors into line. The first apparatus used after the removal of the bicuspids, was a vul-

canite plate, covering the roof of the mouth, and all the posterior teeth, with a grinding surface on the plate, raising the bite about one-eighth of an inch. We first separated the laterals and cuspids, as also the centrals, by drawing a piece of rubber between them, to make the necessary space to adjust around the cuspids, a very thin band of platinum, and secured in position with insoluble cement. (For this useful contrivance we are indebted to Dr. W. N. Morrison, of St. Louis.) Then we fitted a band of the same metal to the incisors, with hooks to go over the cutting edges of the centrals, and a hook passing between the centrals; or in other words a T arrangement. In the center of the plate a pin from an artificial tooth was fastened, and also four others both inside and out, opposite the first molars. To these we attached a strong rubber band, on each side, drawing them firmly and securing them to the bands on the cuspids. Then the T was put in place, and a band drawn from the center to the hook on the T. Smaller bands were also carried from the inside pins to the hook. In this way we had three bands operating on the T to draw the incisors back, and at times

Fig. 29.—Chin cap. (George W. Keely.)

Fig. 30.—An apparatus of vulcanite. (George W. Keely.)

doubled the power on the cuspids. The plate was cut away back of the incisors so as to wholly relieve all pressure on the parts in that region. This apparatus was worn for about two months, but removed and cleansed almost daily, and the patient required to cleanse her teeth. The bands around the cuspids of course, were allowed to remain until their mission was accomplished.

"At the end of two months a new plate was made, leaving ample space, so the incisors could be drawn back and into line.

"The next apparatus used is like the one described by Prof. Norman W. Kingsley, as seen in his excellent work on *Oral Deformities*, page 134. This is shown in Fig. 29.

"A perfect impression was taken of the six refractory teeth, and a vulcanized cap made on the model. The cutting edges fitting in the cap, arms an inch long extend out at each corner of the mouth. The skull cap was made of leather and strong rubber bands attached to it, the cap over the teeth adjusted and the bands drawn down and hooked on the arms. This apparatus finished the work

of drawing the teeth in line, and at the same time forced them up into their sockets nearly one-eighth of an inch. At the end of four months she was dismissed, but required to adjust the skull cap arrangement at nights for about six months. She had no trouble in adjusting or removing it, and she seldom removed the rubber bands from the cap. She would simply draw the cap down and remove it, and readjust in the same way."

Ohio Journal of Dental Science, 1887, page 202:

"The following cut (see Fig. 30) shows an apparatus used in this case, but I rarely use it now, having almost wholly abandoned the use of the rubber band in front of teeth to be moved out of lock. When a perfect impression is secured, as also a model, the trial plate is fitted to the roof of the mouth and over the posterior teeth, adjusted, and a bite taken, raising the teeth apart barely enough to allow the refractory teeth to be moved to place. It is necessary to have the bite correct that the patient may have a surface for masticating purposes. A lead band should be fitted to the labial surfaces of the teeth to be moved, about as thick as the space required to draw the teeth to position, and a thin wax band on it with a button opposite each tooth. It is well to have the plate cover the palatine surfaces of the teeth to be moved, that either pins or wedges may be used at the same time the ligatures are operated.

"It requires considerable skill to make and adjust a plate of this kind to remain firm in place, but when accomplished you are well prepared to begin work. Slots may be cut in the plate, opposite the teeth, for the admission of wedges, or holes for pins. Ligatures may be cut from rubber tubing, put over the teeth and drawn to the buttons, thus you will have the wedges and ligatures operating at the same time."

(To be continued.)

HOW TO FIT AND APPLY ANGLE'S RIBBON ARCH

By J. Bertram Stevens, D.D.S., Elizabeth, N. J.

ALL bands are to be fitted and soldered at the chair. Make anchor bands out of coin gold, 32-gauge, soldering buccal tubes thereto. A more accurate fit can be obtained by following this procedure than by using ready-made bands. Place anchor and bracket bands on the teeth and take a plaster impresssion. Put on two coats of shellac and one of sandarac varnish, let stand overnight, then run in Weinstein's artificial stone.

Place one end of ribbon arch in buccal tube, and by careful annealing and bending, it can be sprung to place in each bracket. Remove from brackets and place other end of arch in buccal tube. Loosen up nuts and anneal with blowpipe.

Iron-bending wire should be used to hold arch in brackets for the reason it will not sweat the parts together.

The ribbon arch treated in this way will fit perfectly, and will not put a strain upon any part until manipulated by the operator.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

Under the Editorial Supervision of
James David McCoy, D.D.S., Los Angeles—Robert H. Ivy, M.D., D.D.S., Milwaukee
B. Frank Gray, D.D.S., San Francisco

It is the object of this department to publish each month original articles on dental and oral radiography. The editors earnestly request the cooperation of the profession and will gladly consider for publication papers on this subject of interest to the dental profession. Articles with illustrations especially solicited.

A STUDY IN "IMPACTIONS"—INFORMATION WANTED

By Dr. B. Frank Gray, D.D.S., San Francisco, Calif.

IT is safe to say that where one dentist relied upon the roentgen ray as an aid in diagnosis ten years ago, ten—maybe twenty—now make use of this invaluable agent. Its revelations are so wonderful it seems almost strange we ever could have got along without it.

The illustrations submitted came to me through the courtesy of Doctor A. W. Ward, of San Francisco. Other than the fact that the patient is a young woman of approximately twenty-one years of age, I have no data.

It may be surmised that such a patient presenting herself to the dentist a few years ago, would have been questioned as to the premature decay and loss of her mandibular molars. Even her assurance that these teeth had never erupted might have been questioned, since "people forget." But here the diagnosis as to their presence is assured beyond cavil.

Figs. 1 and 2 are presented, therefore, as a silent plea for the still more common use of the radiograph; and they are also presented in the hope of stimulating a number of the readers of this Journal to enter into a further diagnosis of this case, having in view any surgical or orthodontic procedures that might be of value to the patient in this, or somewhat similar cases.

Noting the impacted status of the maxillary third molars, it may be assumed even were the mandibular third molars brought to a relatively correct position, there would be no assurance of occlusion. I would believe therefore the third molars of both jaws might properly be considered as fit only for removal. This should be done by a competent oral surgeon, of course. In no sense is it an "extraction" in the common meaning of the term.

Assuming these mandibular third molars have been carefully removed, are there those among us skillful enough to bring the first and second molars

Fig. 1.

Fig. 2.

into a fairly good occlusal relation with the teeth of the maxillary arch? If so, what shall the procedure be?

Again the assistance of the oral surgeon must be sought. He may be asked to remove the bone overlaying the molars, and since he is better able to cope with hemorrhage, I believe it would be well for him to secure retention and cement proper attachments to the teeth by which the orthodontist may apply the force necessary to securing their elevation.

These procedures all of us know something about. I feel, however, the majority of us know too little in this connection, as such work has come to our notice rather infrequently. I therefore would be very glad to receive opinions --in fact, short papers—touching upon the case illustrated, or similar cases. Such material may be published in these columns from time to time with a view to benefiting as many as possible along these lines.

I have not touched upon the pathologic symptoms which at times accompany these conditions. It is sufficient to say I do not lose sight of that phase of the subject, and that while it has been well covered by Cryer and others, it is always a subject of interest.

The American Red Cross in France

American Red Cross workers are so popular in the neighborhood of this hospital for refugees near Lyon that the repatriate children even welcome the arrival of the dentist with his instruments. However, by means of pictures, magic lanterns, movies, charts and exhibits, these little folks have learned the importance to France of keeping their teeth in good condition, and like their fathers are ready to serve France even if it does hurt.

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EDITORIALS

Dental Engineering

DURING the last three years this JOURNAL has devoted considerable space to the question of dental engineering as applied to predetermining the shape of the dental arches. We have published various articles on this subject, and have called attention to the subject editorially. We have devoted so much space to the question that we have been criticized by those who have not been in favor of dental engineering as applied to orthodontia; and, on the other hand, we have been criticized for not devoting more space by those who have been enthusiastic in regard to the subject.

By going back through dental literature, we are impressed with the fact that several attempts have been made by various men to formulate some plan whereby it would be possible to predetermine the shape of the dental arch before beginning the correction of malocclusion. By carefully studying the various plans formulated, we find a majority of them seem to be founded on

some sort of a relation which exists between the diameter of the anterior teeth as compared to the width between the molars. We are willing to admit that by measuring a large number of dental arches of modern individuals, we shall find that the diameters of the anterior teeth and the width between the molars will necessarily assume a certain relation or average. By measuring a number of these cases it will be possible to establish a certain ratio as existing between the diameter of the incisors and the width between the molars but after that was done, the question remains, Would that be a scientific plan for predetermining the width of the dental arches? Because we find a certain diameter of the incisors corresponding to a certain width between the molars it does not necessarily prove that every arch which has anterior teeth of a certain diameter has a corresponding width across the molars. In other words, we have been unable to see where the diameter of the incisors alone should be taken as a determining factor of the width of the arch across the first molars. We can see no more reason why the diameter of the anterior teeth should be taken as a guide than the width of the premolars should be taken as a guide.

If we were to begin to measure the height of a large number of individuals, we would find a certain number that were short, and a certain number that were tall, and also a certain average; now the height of these individuals is simply the result of average and not the result of being blonde or brunette or having blue eyes or brown eyes or any other physical characteristics. In other words, facial characteristics have as little to do in regard to the height of the individual as the diameter of the incisors has a positive influence upon the width of the dental arches. We have carefully read the writings of various men who have followed such a plan of predetermining the dental arch and all they have done is the result of averages. The average case of malocclusion is the one in which we do not need a plan for predetermining the dental arch. If everything is of the average, there is no reason the result would not be satisfactory. The case in which we need dental engineering or some kind of a plan for predetermining the shape of the dental arch is the unusual case, and the one in which conditions arise that are seen very seldom.

In an article which advocates the measuring of the incisors, we recall the writer made the statement that the second molars would be set lingual to the first molar. We are willing to admit that we find a large number of dental arches where the second molars occupy a lingual position to the first molars, but they occupy that position not because the incisors are a certain width, but because of mesio-distal diameters of the upper and lower molars. We will find other cases where the second molars do not occupy a lingual position to the first molars, and still other groups where the second and third molars set buccally to the first molar. These different positions of the molars are not the results of differences in the mesio-distal diameter of the incisors, but are the result of differences in the mesio-distal diameter of the upper and lower molars.

Of the various attempts made to predetermine the dental arch and from a careful investigation and study of the different plans proposed, we believe dental engineering as given the profession by Stanton, Hanau, and Fish comes nearer to being a scientific plan for predetermining the shape of the dental

arch than other plans suggested. We have followed dental engineering as advocated by the above writers very carefully and gone over the subjects at various times and examined their methods and charts and believe that the plan of measuring of the mesio-distal diameters of the teeth, considering the overbite in the incisor region, the bucco-lingual diameter of the teeth as related to the bucco-lingual relation of the upper to the lower and the mesio-distal relation of the arches gives the most scientific plan for predetermining the shape of the dental arch. In dental engineering each case is taken upon its own peculiarities and no preconceived ideas of ratios or proportions is advocated in the beginning.

With the plans of predetermining the shape of the dental arch where we are dependent on the diameter of the incisors or anterior teeth for the width between the molars, some writers even admit the plan is only applicable to the average case or the typical American face. According to dental engineering as laid down along the line suggested by the aforementioned writers, the plan is not only feasible with Americans, but it is satisfactory with all races and nationalities. Not only does the plan work with human beings, but it works just as satisfactorily and just as positively in lower animals or animals with extremely different shaped arches than we find in the human face. Dental engineering can be applied successfully to the lower animals because the plan is based upon a consideration of the mesio-distal diameter of the teeth, the bucco-lingual relation of the same and the mesio-distal relation of the arches. We are given a certain number of teeth which are a certain size in the upper and lower arch, they have a definite relation mesio-distally to each other and by engineering methods we construct two arches which are in normal occlusion or are at least the most serviceable out of the material at hand. According to dental engineering the dental arch is predetermined on the same basis as if we had a number of blocks of marble of certain sizes and shapes which had to be arranged into arches, one harmonizing with the other with a definite fixed point which in the dental arch is a mesio-distal relation of the arches and of bucco-lingual relation of the teeth.

We believe the plan for predetermining the shape of the dental arch which has to be limited to a particular type of individual is necessarily unscientific and it is simply nothing more than an average. Dental engineering which takes each case as a particular individual type, and we believe each case is a particular individual type, and predetermines the dental arch upon the anatomic peculiarities of all the teeth is the only scientific plan. We have been criticized several times for advocating the value of dental engineering, but the more study we give the subject, the more we are convinced that it is along the proper lines and the only plan that has been suggested so far which has any scientific value. Other plans are nothing more than a record of average.

We hope that in the future dental engineering will become more serviceable to the orthodontic profession than it has in the past, for we believe that as a scientific contribution to orthodontia it has been very badly handicapped by other conditions which have been unfortunately attached to it. However, the principle is correct, and we believe it is the only correct plan for predetermining the dental arch that has been suggested.

REVIEWS OF LITERATURE

Dental Bacteriology in Relation to Dental Caries

IF an attempt is made to bring some order out of the chaos in which the scientific aspects of dental caries seem to be involved, it appears not unlikely that several factors of unlike character are concerned. They have been fancifully represented as "defensive" on the one hand, and "attacking" on the other. Among the latter group, bacteria and carbohydrates probably deserve the foremost attention in the study of the etiology of decay of the teeth. The pioneer studies of Miller on the bacteriology of the mouth gave great weight to his views; hence even today his conception of dental decay still is prominent. Miller's idea was that lactic acid or similar acids produced by bacterial fermentation of the carbohydrates in the mouth are responsible for the decalcification of the enamel, and that the exposed dentin is further destroyed by the proteolytic ferments of the same or similar bacteria. But as Meyer[1] has pointed out in a review of the present status of dental bacteriology, neither Miller nor any of the subsequent investigators has succeeded in finding any organisms strictly specific for caries.

The medical profession has scarcely yet become familiar with the more recent studies of Kligler[2] in this country on the microbiotic flora of the normal mouth and also the changes observed when dental caries occurs. All the families of bacteria are represented in the healthy oral cavity. Most predominant are the representatives of the cocci and streptothrica or tricomycetes group. On the healthy teeth the types of organisms and their relative abundance remain apparently constant, although with the changing conditions in the mouth there is a variation in the total numbers of bacteria. From the available data Meyer has gathered that the number under ordinary conditions in 1 mg. of deposit consists of about twenty-five million organisms, of which one million can be cultivated. In dirty mouths the counts were about twice as high. The growth of oral micro-organisms is just as much influenced by changes in the mouth as is the case for bacterial activity and growth in the soil or in the intestinal tract. The total number of bacteria increases during the night and immediately following a meal. Miller adds that the stagnant conditions in the mouth inducing concentration of fermentable carbohydrates causes a shift in the general relationship of the types to one another, a decrease of the cocci and increase of the forms characteristic for early stages of decay. The number of bacteria on unbrushed teeth were about four times as great as those on brushed teeth. Three times the number of organisms were found in dental deposits immediately after meals, in contrast with that present before meals. Brushing of the teeth or chewing tobacco removes about three fourths of the total number of bacteria.

The first stages of caries which, in the judgment of Kligler, can be con-

[1]Meyer, K. F.: The Present Status of Dental Bacteriology, Jour. National Dental Assn., 1917, 4, 966.
[2]Kligler, I. J.: Jour. Allied Dental Soc., 1915, 10, 141, 282, 314.

sidered a specific infection, show enormous counts and an entirely different flora from that of normal teeth. With the progress of decay the character of the dominant micro-organisms changes. As Meyer has summarized it, in comparison with the clean and normal mouth, there is a decrease of the streptococci in all stages of decay and a marked increase in the acidific bacilli. The medium of the mouth is poor in proteins and usually contains carbohydrate; therefore, it is unsuitable for proteolytic organisms. Only in such portions of the buccal cavity, like decayed teeth, where symbiosis with strongly aerobic organisms and cumulation of nitrogenous material produces a suitable soil, can strongly proteolytic anaerobic bacteria exist and develop.

Let it be clearly asserted that the relations of cause and effect are by no means clearly demonstrated in the bacteriologic studies of decay made up to this time. But if one is justifiable, from such somewhat indefinite findings as are presented, in assuming that oral micro-organisms are in some way or to some degree responsible for dental decay, it is logically in order to attempt to eliminate the causal agents. As Meyer indicates, sterilization by chemical means is impossible; and the use of such procedures may actually be harmful to the tissues of the mouth cavity. There is something both novel and modern in the further suggestion of studies along chemotherapeutic lines leading to the possible discovery of highly parasitotropic and slightly organotropic substances in an attempt to gain mastery over the objectionable micro-organisms. The further existence of possible foci of systemic infection in the mouth cavity opens up still different problems. It seems likely, indeed, that bacteriology and the dental clinic will become more closely related to each other in the immediate future.—*Jour. Am. Med. Assn., Sept.* 21, 1918.

Elementary and Dental Radiography*

THE second edition of Raper's work "Elementary and Dental Radiography" which recently made its appearance contains so many valuable facts relating to the subject that it should occupy a prominent place in the library of those who are interested in radiography. The first chapter of the book deals with the elements of electricity, with which all should be familiar who are engaged in this work. The various types of x-ray machines are also described, with diagrams which are very intelligible, and by careful study will give any one a very good idea of the various sources from which the rays are derived with the different machines. The different parts of the machine and all of its accessories are also described in a very complete manner. One of the most important chapters is that dealing with the making of dental radiograms which shows various positions of the patients and the tube and different radiograms which are obtained from various positions.

The technic of making the negative and developing it is also carefully described, as well as different types of developing apparatus, dark rooms, and

*Elementary and Dental Radiography. By Howard R. Raper, D.D.S., Professor of Roentgenology, Operative Technic, Materia Medica and Therapeutics of the Indiana Dental College, Indianapolis. 502 pages, 600 illustrations. Published by the Consolidated Dental Manufacturing Company, New York. Cloth, $7.00.

developing chambers, which will be found very valuable to those contemplating equipping an x-ray laboratory. The uses of the radiograms in dentistry and the reading of the same are also given important places and the large number of illustrations employed tend to show practically every condition met with in the study and interpretation of radiograms.

The book contains over five hundred illustrations, which cover the subject of radiography in a very complete manner, and we believe it is a valuable contribution to the dental literature.

General Pathology and Bacteriology for Dental Students*

THE second edition of Dr. McConnell's works, "General Pathology and Bacteriology for Dental Students" follows the same general plan as the first edition and covers the field of dental pathology and bacteriology in a very satisfactory manner. The work is divided into sixteen chapters, which deal with pathology in a general way, the disorders of metabolism, circulatory diseases, and retrogressive processes. Inflammation and regeneration are covered in a very satisfactory manner and are followed by a chapter on specific inflammation dealing with various conditions which have a direct bearing upon the oral cavity. Tumors are also covered in a very satisfactory manner with a number of good illustrations of various types. A valuable chapter of the work is that devoted to the tonsils, pharynx, salivary glands, and focal infections, which should belong to the mouth but, as a rule in times past, have been neglected.

Chapters IX to XVI are devoted to bacteriology, which covers a consideration of the various forms of bacteria, sterilization, disinfection and laboratory methods. The book covers the subject in a very good manner and if any criticism would be offered of it, it would be that it covers too large a field and does not give enough detail on some subjects. However, as a small-sized textbook covering the subject of pathology and bacteriology, we do not know of any work that does it so well in such a small space.

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*General Pathology and Bacteriology for Dental Students. By Guthrie McConnell, M.D., Director of the Clinical and Roentgenological Laboratories of the Waterloo Medical Society, Iowa. Captain, Medical Reserve Corps, U. S. N., formerly Professor of Pathology and Bacteriology in the Philadelphia Dental College. Second edition revised 12mo of 314 pages with 103 illustrations. Philadelphia and London: W. B. Saunders Company, 1918. Cloth, $2.50, net.

Sixty-Eight Vacancies in the Dental Corps, United States Army

1. The Acting Surgeon General of the Army announces that there are at the present time 68 vacancies in the Dental Corps, the United States Army, and that examinations for the appointment of dental surgeons will be held at various points in the United States on Monday, November 4, 1918.

2. Application blanks and full information concerning these examinations can be procured by addressing "Surgeon General, U. S. Army, Washington, D. C."

3. The Dental Corps is a constituent part of the Medical Corps of the Army, and consists of officers in the grades of colonels, lieutenant-colonels, majors, captains and first lieutenants. Appointments therein are made at the rate of 1 for each 1,000 of the total strength of the Regular Army, authorized from time to time by law. Law requires that first lieutenants of the Dental Corps shall serve 5 years in that grade before being promoted, but for the period of the existing emergency this provision has been suspended by Act of Congress, and after one year's service as first lieutenant a dental surgeon is eligible for promotion to the grade of captain, after which promotions are made in order of seniority as vacancies occur in the higher grades.

4. No applicant may under existing law be commissioned in the Dental Corps unless he is between 21 and 32 years of age, a citizen of the United States, a graduate of a standard dental college, and of good moral character, nor unless he shall pass the usual physical examination required for appointment in the Medical Corps, and a professional examination which shall include tests of skill in practical dentistry and of proficiency in the usual subjects of a standard dental college course. Whether or not the applicant is married has no effect upon his eligibility for the Dental Corps.

5. Application for appointment must be made in writing to the Surgeon General of the Army, upon the prescribed blank form. All the interrogatories on the blank must be fully answered. In compliance with the instructions thereon, the application must be accompanied by testimonials, based upon personal acquaintance, from at least two reputable persons as to the applicant's citizenship, character and habits.

The selection of the candidates is made by the Surgeon General from the applications submitted, and a formal invitation to report for examination to the most convenient examining board in each case will be issued by him.

6. The examinations are conducted under instructions from the Surgeon General, and usually last six days. No allowances can be made for the expenses of applicants undergoing examination, whether incurred in travel to and from or during their stay at the place of examination, as public funds are not available for the payment of such expenses.

Each applicant, upon presenting himself to the board, will, prior to his physical examination, be required to submit his diploma as a graduate of a standard dental college. Should he fail to do so, the examination will not proceed.

7. A first lieutenant receives $2,000 per annum; a captain $2,400 per annum; a major $3,000 per annum. These salaries are increased by 10 per cent for each period of 5 years until the maximum of 40 per cent is reached, excepting that the maximum salary of a major is $4,000 a year, and that of a lieutenant-colonel and colonel is $375 and $416.66 per month, respectively. In addition to their pay proper, they are furnished with a liberal allowance of quarters according to rank, either in kind, or, where no suitable Government building is available, by commutation. Fuel and light therefor are also provided. When traveling on duty an officer receives mileage for the distance traveled. On change of station he is entitled to transportation of professional books and papers and a reasonable amount of baggage at Government expense. Groceries and other articles for their own use may be purchased from the Quartermaster at about wholesale cost prices. Dental Surgeons are entitled to medical attendance and hospital treatment without charge other than for subsistence.

8. Officers of the Dental Corps are entitled to the privilege of retirement after 40 years' service, or at any time for disability incurred in the line of duty. On attaining the age of 64, they are placed on the retired list by operation of law. Retired officers receive three-fourths of the pay of their rank (salary and increase) at the time of retirement.

9. In order to perfect all necessary arrangements for the examination, applications must be in the possession of the Surgeon General at least two weeks before the date of examination. Early attention is therefore enjoined upon the intending applicants.

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ORIGINAL ARTICLES

MUSCLE TRAINING AND ITS RELATION TO ORTHODONTIA*

BY ALFRED PAUL ROGERS, D.D.S., BOSTON, MASS.

WHEN the Chairman of the Board of Censors invited me to read a paper before this meeting, I suggested the title which appears upon the program; but by the time I secured the leisure to collect my material, it became quite evident to me that what I really wished to say to you at this time could better be said under the title, "Muscle Training and Its Relation to Orthodontia." I, therefore, ask indulgence while I proceed to discuss certain questions of vital importance to the profession—questions which are of more immediate practical nature than could be dealt with under the title upon the program.

It is often said that we, in our human experience, learn more from and accomplish more by the study of our failures than by the contemplation of our successes. More or less frequently there occur in the practice of each of us failures to maintain the results of our conscientious efforts. It is true that some of our failures are due to causes which are, at the present time, quite beyond our control. We have many types of children to deal with—children of varying degrees of mentality, health and discipline. It is quite impossible with some children to obtain results where the elements contributive to failure are due to some mental defect making our efforts for that particular individual quite useless. In contemplating certain types of failures in my own practice, I have been reminded that a closer study of those forces of occlusion which could be placed under our immediate control might form a basis upon which to secure more permanent and satisfactory results. It is true that our teachers have been diligent in the past in calling our attention to the various natural forces that contribute to the establishment and maintenance of the occlusion of

*Read before the Eighteenth Annual Meeting of the American Society of Orthodontists, Chicago, Illinois, August 1, 2, 3, 1918.

the teeth. Doctor E. H. Angle, Doctor Martin Dewey, and others, have written upon this subject, reminding us of the importance of the various natural forces, such as cell metabolism, forces of the inclined planes, normal approximal contacts, harmony of shape and sizes of the dental arches, atmospheric pressure, and muscular pressure. Those elements which have received the greatest share of our practical attention have been the mechanical forces of the inclined planes and the size and shape of the arches. There is one force, however, a thorough comprehension of the importance of which, it seems to me, has failed to penetrate the mind of the orthodontist in general, although it has been often written about. We have been told how occlusal force and muscular pressure aid the teeth in taking very nearly their proper positions in regard to their buccal and lingual relations, and that normal muscular pressure upon the anterior teeth tends to hold them in their normal relation; yet we have found that in many cases where malocclusions have been corrected, where inclined planes, points of contact, and arch forms have been successfully established, the unbalanced muscular forces have still left our cases in a state of semitreatment.

It is interesting to read from Doctor Angle's observations regarding muscular behavior contained in the second chapter of the seventh edition of "Malocclusion of the Teeth", where he says:

"The influence of the lips in modifying the form of the dental arches is an interesting study, and almost every case of malocclusion offers some noticeable and varying manifestation of it."

In speaking of the upper and lower lips, he further says:

"This force is exerted automatically in response to almost every emotion, and results in maintaining the teeth in harmony with the graceful and beautiful curve of the normal individual arch. In cases of malocclusion, strikingly characteristic abnormalities in lip function are often noticeable, leading to the suspicion that more often than is recognized the peculiarities of the lip function may have been the cause of forcing the teeth into the malpositions they occupy."

It avails us little if we diligently seek to place one part of the human machine in harmonious relation, and neglect that other part upon which permanent success depends. As I have already intimated, our teachers have recognized the importance of muscular pressure in its normal conduct as well as in its abnormal conduct, but here they seem to have stopped, assuming that with the correction of the faulty osseous formation and cusp relation, nature, somehow or other, would establish the correct muscular tone and muscular habits. All of us can recall cases which failed after an unduly prolonged retention—cases of every class and description. It was because of the recognition of these elements that in 1906, in a paper on "The Correction of Facial Inharmonies," read before the Northeastern Dental Association, I was led to say:

"The logical solution of our difficulties, from nature's standpoint, would consist in inducing every organ to perform the normal degree of functional activity. Would that children lived in a normal and healthy environment, for then, slowly but surely, facial inharmonies and malocclusion would become less and less prevalent.

"We must likewise resort to artificial means in order to stimulate those

organs which, having been allowed to degenerate, have failed to perform their natural functions. We must bring into normal position malposed teeth, harmonize the distorted arches, and restore the facial lines to their original grace and beauty."

We know that health means harmony of functional adjustment. If disharmony of function reigns in any part of the organism, it means that some form of interference has influenced the harmonious activity of the affected organ. The psychotherapist in his study of the maladjustment of the nervous system seeks to find those elements of interference which tend to unstabilize the normal functional activity of that system. He recognizes that the nervous system is most delicately balanced and in some individuals the merest suggestion of interference may cause the gravest symptoms of disorder. What is true in relation to the psychotherapist in his investigations will be found true in the experiences of all men, no matter what part of the human organism they have chosen to place under their particular guardianship. If the orthodontist stops to think, he can not but come to a sense of realization that all mechanical and muscular adjustments from the grossest to the more delicate are subjected to disharmonizing influence by myriads of forms of interference whose existence it is his business and duty to investigate. His work should carry him into sympathetic touch with not only the general physician and rhinologist, but with the psychotherapist, the orthopedic surgeon or medical gymnast. In fact, he must have a sympathetic and an open mind toward all sciences which attempt to harmonize the functional activities of the human body. To enumerate the various forms of interference which are especially significant regarding our work, would, I think, take too long for the time at my disposal, but briefly speaking, we have the mental interference, evidence of which is seen in various muscular and nervous habits—the respiratory interference, which may be a factor in insufficient bone growth; then we have postural interferences, which throw the organism more or less completely out of mechanical adjustment; the interference in cusp relation, which reacts upon the guiding and developing muscles of the face. When these influences have been grouped, we are interested to observe how they react upon one another, tending always toward further disharmonious action and the final breaking down of the health of the organism.

I have found, as you all have, that the muscular tissues of the face, where they have once acquired the habit of bad behavior, do not readily assume the normal. That some form of training was necessary became very apparent, and with this conviction solidly established, I proceeded to formulate and practice definite forms of muscle culture for the facial muscles. I soon found that in order to be successful in this branch of the work, it was necessary to make careful study of the various adjustments of the muscle groups, and that in order to obtain proper muscular control, we must also seek to obtain satisfactory mental control. Also, that it is necessary, at the outset, in order to obtain results, that the parent and the child be convinced of the importance of the work and be given their part in the responsibility for future success or failure.

In some forms of malocclusion, the unfavorable position in which muscles appeared to be placed to perform that particular work which they were sup-

posed to do was apparent, and I became strongly convinced that these intricate muscles must be carefully trained in order to assume the exquisite positions in which their normal actions would place them. I soon discovered that ordinary muscle culture would not bring the desired results as quickly or as permanently as a thorough practice of conscious control over the facial muscles. The object of my efforts has been to teach those patients in need of this form of treatment to consciously use the muscles and forces of occlusion, after first being instructed as to their proper positions.

This muscular work, of course, must go along hand in hand with the mechanical treatment of the case, and no undue muscular pressure must be allowed until the patient has learned to place the arches in their proper relation, which function is taught them after the major interferences have been removed. The object of the work is to so strengthen the muscles of mastication that they will assume their normal function not only resulting in a maintenance of occlusion, but in building a stronger masticatory apparatus as well—that the so-called muscles of expression shall be so trained as to be under conscious control, and not allowed to "run riot in response to almost every emotion."

It can be readily understood, then, that we are justified in concluding that our work will be even more enhanced if we are able to obtain the harmonious development of the entire organism. We have accustomed ourselves to think so exclusively of the region of our special effort, that we fail many times to realize that nature works as a whole, and, in order to eradicate any special difficulty, it will be well if, in the young, we can obtain a correct mechanical advantage in all parts of the organism. In order to obtain these great advantages, we must begin at once to consider the value of conscious control in its relation to our work.

It will be essential for the orthodontist of the future to add the science of kinesiology to his course of studies. This science deals with the study of muscular movement, and includes consideration of muscular exercises of all kinds —the reasons why they are performed, their correct performance, and their reactions. He will learn from this study much that will be of value to him regarding various defects and their cures. In the future, I believe, the student of orthodontia will be called upon to make analysis of complex muscular movements, noting carefully the muscles that are involved, and the scope of their influence, applying this knowledge to the muscles of the face. He will soon learn that the work accomplished by the muscles reacts again upon these muscles, developing them and establishing a greater efficiency in action. He will learn that the reactions are not only developmental, but that they are also mechanical by the influence and the relationship which exists between the joints and the shapes of the bones themselves. The orthodontist, then, in order to become completely efficient, will need to understand muscles in their various conditions, and will need, during his treatment of a given case, to have their intricate influences constantly before him. His study of anatomy, myology and physiology, will take on a new interest, because he will have a definite, well-defined reason for understanding the muscles and their function. Giving attention to this subject, it will soon be discovered that the abil-

ity to analyze and solve the various problems of muscular action will not be so easy, because there is an infinite variety of movements and change in form, all of which have their influence in young childhood when they play over and upon the delicate osseous development of the tissues of the face.

The study of this subject is fascinating, because of the intricate and exquisite adjustment which may be discovered. In this relation, I would like to call the attention of my hearers to the danger of misapprehending the essence of scientific muscle culture. I was reminded of this at a meeting at which I read a paper upon this subject. An orthodontist present remarked in the discussion that the act of chewing gum seemed to him in line with the work which I was advocating regarding muscle culture. I should dislike very much to have this empirical view of such important work become prevalent, for the reason, first, that the act of chewing gum for the development of the uncultured muscles is essentially nonscientific, and may be productive of much harm. Somewhere it has been written and emphasized that when inclined planes have assumed an unnatural position, the more they are used, the more severe the malocclusion is apt to become. This is because they are in a position of mechanical disadvantage. To thoughtlessly prescribe a course of gum-chewing to a little patient suffering from a developing Class II, would indeed be poor professional advice. It would be equally disastrous if a patient suffering from a developing Class III, or even a Class I, were to be subjected to an undue amount of muscle tension, with its malinfluence upon the mechanical disadvantage exemplified by the maloccluding planes. After the arches have been developed and the patient has acquired the ability to place the arches and inclined planes in proper relation with one another, a gum-chewing prescription might have some excuse for existence, but even then it is of doubtful value. We are not quite sure that it is a good thing for the digestive apparatus to be subjected to an increased flow of saliva when the natural functions of the alimentary canal do not at that time call for this flow. Nor are we sure that the salivary glands would take kindly to a prolonged course of this kind of treatment and submit gracefully to an overstimulation of their function. It is, moreover, true that the child is apt to develop one side of the mouth much more than the opposite side. Again, it becomes a subconscious habit and loses that particular value which is to be derived by the conscious control resulting in a harmonious unification in the development of all the muscles involved.

In our instructions to patients, it is much better for us to strive to direct the patient to comprehend the control and coordination of his muscles through conscious, well-directed efforts, than to allow him to automatically perform certain prescribed exercises. This mental and muscle training will not only have a beneficial effect upon those parts about which we are directly concerned, but will be of immense value to him in other important acts of his life. Therefore, before the child is allowed to undertake any form of physical work, he must be brought to a realization of the need and importance of such endeavor. The orthodontist in his contact with his patient must discover for him the defects exemplified by the misuse of the various muscle groups. When this has been accomplished, he should then undertake to teach the patient how to inhibit those

sensations which induce him to an imperfect use of his muscular mechanism. He must be taught to understand the imperfect mechanical relations which exist, and must be given also to understand correctly the positions of mechanical advantage; and then, by supplying him with new and correct guiding impulses, he will acquire, in time, the ability to bring about the proper use of his muscular mechanism.

Having then before us the principles of procedure, we are prepared to consider their practical application. The principles are: *First, the mechanical reestablishment of arch form and cusp relation by the simplest mechanical means, thus removing any interference which tends to discourage the normal functions of the muscles. Second, the principle of muscular balance and mechanical advantage in the complete organism, including special guidance and control of those muscles concerned in the particular weakness upon which our attention is to be directed, urging them on to their normal development and strength until the harmoniously developed face completes the restoration of the organism to its normal inheritance.*

We can readily understand that the motor efficiency of the parts of the body upon which we are directing our attention depends upon the ability of our patient to gradually attain the faculty of directing mental stimuli in sufficient amounts to effect their development. It is because of the law of mental growth, known as repetition, that the orthodontist realizes his greatest encouragement regarding this phase of his work, because the things that are done from choice tend to become spontaneous, if often repeated. Therefore, the ability of the muscles to continue the performance of their full functions after repeated efforts of the will, is assured by the educated state of both mind and muscle.

With these ideas firmly established in our minds, we can now proceed to consider and illustrate briefly the practical means by which these changes are brought about.

Fig. 1 represents what we are pleased to accept as the standard—the anatomic section of which gives us a comprehensive view of the area over which certain groups of muscles exert their influence. It is a principle in the procedure of treatment through the stimulation of natural function to rid this space as completely as possible of any apparatus which has a tendency to interfere with the normal action or conscious guidance of the lip and cheek muscles.

It is unfortunately true that in many growing cases it is absolutely essential to our ultimate success that we make use of certain forms of mechanical apparatus; but it is essential to so design them that they will interfere the least with the normal muscular activity.

Textbooks on orthodontia frequently show illustrations of appliances filling the buccal and lingual spaces. The use of these appliances would not be compatible with the simultaneous encouragement of functional activity of the soft tissue. It would be difficult under such circumstances to train the muscles to a free and unhampered action. In most cases I have found the use of the lingual wire (Fig. 2) to be more nearly in accord with the principles we are considering. In younger cases, where the deciduous teeth are still present, the junior

pin and tube appliance (Fig. 3) is sometimes made use of during the early stages of treatment, being removed after a sufficient development has been obtained to allow a free eruption of the teeth—the lingual wire being used on the lower to secure the arch development while the muscles of mastication and expression are being trained to their normal activity. The next (Fig. 4) illustrates the advantage to be gained by the use of the lingual wire.

"The most valuable appliances are those which interfere least with the normal tendencies of development, and in their construction and adaptation are freest from interference with muscular activities and habit-forming possibilities. When it is found necessary to interfere with any normal function whether it be of the tongue, lips or cheeks, some form of compensation must be

Fig. 1.

Fig. 2.

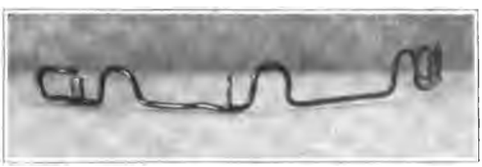

Fig. 3.

provided. Possibly an illustration here will help us to grasp my meaning to better purpose.

The drawing represented in Fig. 5 indicates the direction of the movement for each of the three appliances: labial wire, pin and tube, and lingual wire. It will be seen that with the use of the lingual wire there is greater opportunity for muscular influence in its relation to the individual tooth movement. The expansion arch which for so long a time was our mainstay is, in my opinion, in the light of recent years of experience, a more or less troublesome appliance; especially in regard to its effect upon the normal action of the lips and cheeks, and most noticeably so when it is poorly adjusted, as is often the case. It will be seen that this application, even when neatly accomplished, interferes and forms a barrier between the lips, cheeks and teeth so that their normal function is seriously interrupted. On the other

hand, the lingual wire can be neatly placed where it gives the minimum interference to muscular action. (Fig. 6.)

Briefly then, we have considered the advisability of the simplicity of mechanical interference, paving the way in seeking the greatest advantage to be derived from the stimulation of muscular activity. It will be logical now for us to proceed to a consideration of the various muscle groups and the methods best adapted for their proper development.

The orthodontist among his recollections of failures has a keen sense of the presence among that ghostly group of various forms of Class II which have failed of retention after his prolonged and conscientious efforts with inter-

Fig. 4.

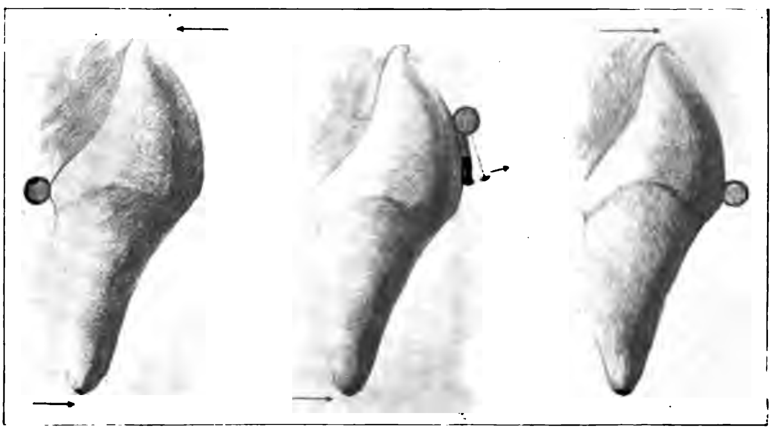

Fig. 5.

maxillary elastics and various forms of retention. Doctor Angle, in his seventh edition, writing of a case treated without intermaxillary elastics, speaks as follows:

"About three years after the discontinuance of retention, on examining the facial lines and the teeth of the patient, an important discovery was made, namely, that although the normal relations had been maintained between the teeth, the mandible had slowly drifted back to probably very nearly its former relations with the skull, but in so doing, the crowns of the teeth of the upper arch had been dragged distally to a noticeable degree, while the crowns of the teeth of the lower arch had been tipped forward. In other words, there

had been accomplished by the muscles of mastication and persistent, difficult retention, what we now aim to accomplish and do accomplish with the Baker anchorage, often in so short a time as three weeks in patients of this age."

Failures of this nature would be much less common with us if the orthodontist understood and applied the principle of conscious control of the muscles of mastication, training them and causing them to do the greatest activity in their normal position. The evident failure in this case was due to an abnormal action of the muscles of mastication, which might have been corrected had the proper attention been given them. It is interesting for us to note at this point in the discussion what Herbert Spencer has to say regarding situations of this nature, taken in a broad sense. He writes:

"Each faculty acquires fitness for its function by performing its function; and if its function is performed for it by a substituted agency, none of the required adjustment of nature takes place, but the nature becomes deformed to fit the artificial arrangement instead of the natural arrangements."

Frequently by the use of intermaxillary elastics, arches are more or less

Fig. 6

misshapen on account of the unusual strain brought about by the extreme force which is required if the intermaxillary elastics are to overcome the triple resistance of mind, muscle and malposed teeth.

The patient may in the early stages of treatment in these cases be trained to overcome the handicap by applying proper mental stimuli; and when the time appears when proper adjustment of the mandible with the rest of the skull is possible, the adjustment takes place quite normally and then, if it is supplemented by the strengthening of the masseter and temporal muscles, results are permanent and more beautiful because of the harmonious development and action. In contemplating work of this nature, the orthodontist must ever bear in mind the fact that muscles tend to stay in the position in which they do their most and hardest work, and that this work must be done with the arches in their true relation one to the other, for it is then that the masticatory apparatus has assumed the position of mechanical advantage, and it will be surprising how quickly the various muscle groups will respond to the work thus placed upon them, because they are in the position which nature has intended that they should occupy.

It will be logical for us at this point to direct our attention to that most important group of muscles—the external and internal pterygoids. The advantageous positions which Nature has given these groups will be readily seen. They are the muscles which control the movements of the mandible. During early life they are readily controlled, which accounts largely for the fact that they often give way to the suggestions furnished them by slight interferences incident upon the narrowing of the upper arch and by the interference of the upper lateral incisors in lingual occlusion. If the mandible is forced into distal position, these muscles soon form the habit of keeping it there. It may be well for me at this point to emphasize the importance of the early exercise of these muscles in cases where it is required. This is true even where

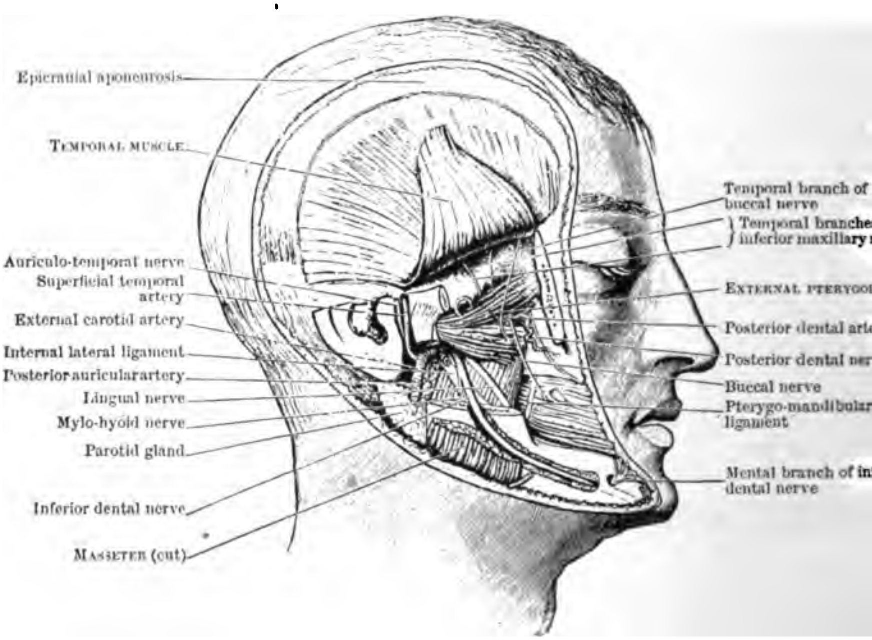

Fig. 7.

intermaxillary elastics are proposed, or where inclined planes upon the anterior teeth are contemplated. (Fig. 7.)

Particularly is this necessary when we contemplate the changes that take place in the glenoid fossa as the child grows to maturity. You have all experienced, in treating younger cases, the voluntary shifting of the mandible upon the removal of the interference frequently caused by an abnormal narrow upper arch, or perhaps the interference of upper lateral incisors in lingual position. The voluntary change does not take place so readily in older children, for the reason that the glenoid fossa has become of such shape as to discourage the pterygoid muscles in overcoming the handicap. It is good practice in cases of Class II to train these muscles through exercise, so that the proper position of the mandible is readily taken when opportunity is given to it. It not only relieves strain upon the teeth, but avoids many other complications. Of course, there are cases in which light intermaxillary elastics will be found of

advantage. In changing our methods of practice, it is not always wise to jump abruptly from one idea to another until we have made so sure of our footing that there is little danger of failure. When intermaxillary elastics are to be used, it seems to me that the operator should study to make his use of them as light and their period of use as short as possible. The exercise of the pterygoid muscles previous to the application of inclined planes on the anterior teeth I have found of great service, as the mandible may be readily trained to take the forward position, avoiding greatly the strain which is usually heaped upon the incisors, if this form of apparatus is placed upon them without taking this precaution. Viewing these illustrations, and reviewing the possibilities consequent upon the control of these muscles, it will, it seems to me, be logical for us to regard them as intermaxillary elastics of nature. And I believe you will agree with me that when they have been trained

Fig. 8.

to perform their functions accurately and well, they may be depended upon to furnish us a guarantee of unusual merit for the permanence of our treatment. The exercise of these muscles consists in throwing the mandible forward, as shown in Fig. 8. The patient requiring this form of exercise is instructed to throw the mandible forward as far as possible, or until the lower anterior teeth are placed in labial occlusion to the uppers, and held there for ten or more seconds and then slightly relaxed. The effort is then repeated as many times as the nature of the case requires. In some cases this will at first be found impossible, but after practice the work becomes easy. This form of exercise is usually prescribed in cases of distal occlusion, and the operator must here be careful in his diagnosis. (Fig. 9.)

The liability of overstimulating these muscles in the very young will be obvious to any of you who have thought at all upon this subject. Very little of this exercise is sufficient in the case of some, while in others it is almost

impossible to overdo it. Still further efforts are made for some patients, as shown in Fig. 10, and is a combination of a posture exercise of unusual merit, and the pterygoid exercise. The patient is directed after taking the position

Fig. 9-A.

Fig. 9-B.

Fig. 9-C.

here illustrated to stretch the point of the chin upward as far as possible, bringing vigorous strain upon the platysma myoides. Fig. 11 gives an example of the improved condition after a few months of this exercise in a case

of Class II. The only apparatus used in this instance was the upper lingual wire, through whose instrumentality the interference of a narrowed arch was removed. After the ability to place the teeth in proper relation had been acquired, the patient had another exercise added—that of the temporal and masseter muscles. This exercise consists of holding the teeth firmly in occlusion and alternately contracting and relaxing the groups of muscles shown in Fig. 12. In many cases it will be found that the ability to contract these

Fig. 10.

Fig. 11-*A*.

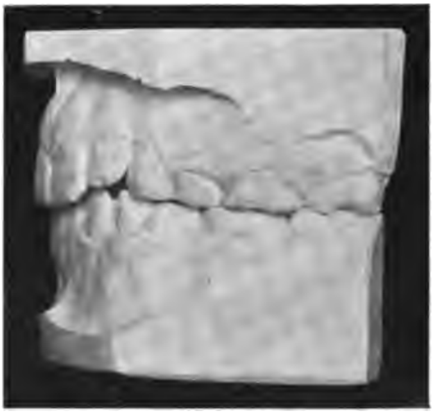

Fig. 11-*B*.

muscles is very slight indeed, but after a few months' practice, the operator is gratified to find greatly increased tone and improved control, as is shown by the ability to contract and relax. All efforts must be made with great concentration, and must be complete in their relaxation and their contraction. The ability to completely relax these muscles between each impulse is important to secure, as muscles exercised in this manner, for physiologic reasons, grow stronger much more quickly.

Fig. 13 shows a child in the act of stimulating these groups. The position of the fingers is useful, in the beginning, in teaching the child to detect the movements.

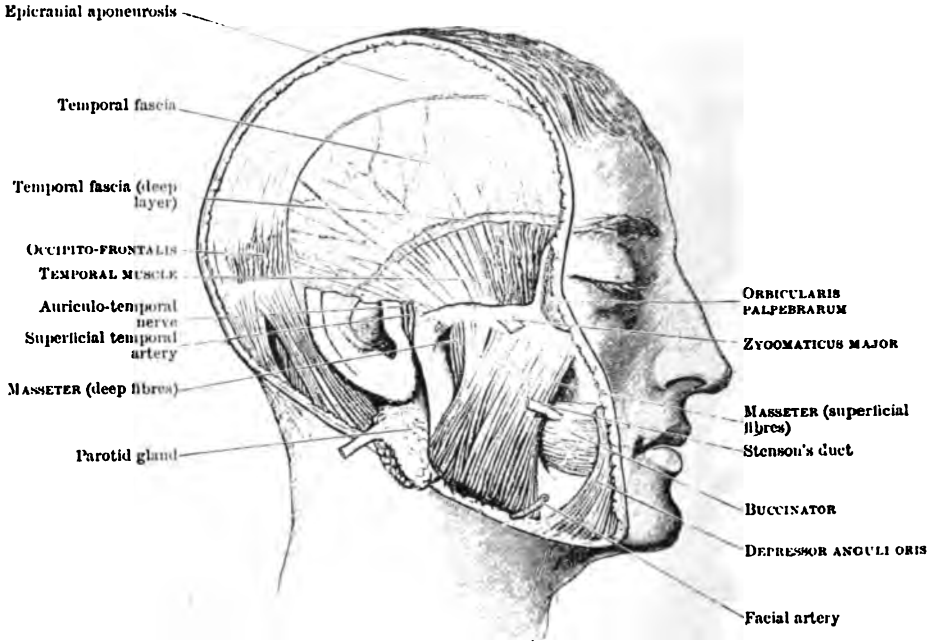

Fig. 12

Fig. 13.

Fig. 14.

Fig. 14 shows a form of exercise for these muscles which may be given when it is not wise to place the teeth in occlusion, and is used sometimes in anticipation of the exercise just described. It is performed by directing the

child to pit the muscles of mastication against those of the hand and arm, alternately contracting and relaxing.

Fig. 15 illustrates a case of a young child ten years of age, who was suffering from lingual occlusion of the upper bicuspids and molars. By the use of the lingual wire the upper arch has expanded until the lingual occlusion

Fig. 15.

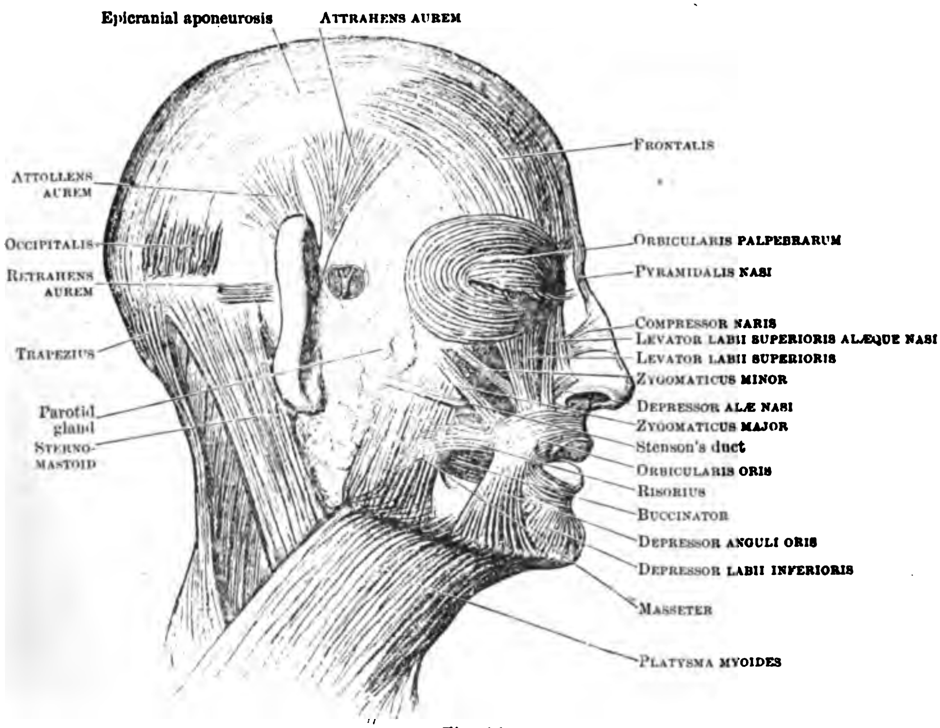

Fig. 16.

was disposed of. When this point of development was reached, as you will all readily understand, the condition of the open-bite was much exaggerated, and this is when the patient was instructed in the use of the exercise of the temporal and masseter muscles. The figure on the right represents this same case a few months later, showing the correction of the open-bite brought about

solely by this means. The child's ability to masticate has been wonderfully improved, and it may be said in passing that the high degree of nervous irritability, present at the start, has largely disappeared, and the child shows a generally improved physical condition.

Fig. 16 gives a general view of the lesser groups of muscles, but none the less important to the orthodontist. They consist of the levator labii, depressor labii, zygomaticus, orbicularis oris and platysma myoides. The names of some of these muscles indicate their function, and are perfectly well known to you. If they lack tone, or are not under control of the nervous system, they are the muscles which are most apt to place perplexing problems before the orthodontists. Most of these muscles are in some way attached to the orbicularis oris, and when we have a general lack of tone in all these muscles,

Fig. 17.

there is sure to be a lack of balance between them and the inner forces, such as the tongue. There are numerous exercises which can be used for stimulation of these groups, but it is not my purpose in this paper to deal particularly with these exercises. It might be well, however, for us to direct our attention to the orbicularis oris. Many of you, no doubt, have had difficulty in retaining the upper incisors in correct position. It is necessary, frequently, to apply retaining apparatus to effect this purpose, but if, in the meantime, this muscle has not been strengthened, in case it originally lacked tone, upon the removal of the retaining apparatus the incisors again become protruded. I have several cases in my practice where better results have been obtained in cases of this character without any retaining apparatus at all. One particularly obstinate case yielded to treatment applied for the strengthening of the orbicularis oris muscle. One valuable exercise I have found for strengthening this muscle is shown in Fig. 17, and consists in pitting the strength of

the thumb and first finger, or two first fingers, against the contractile forces of this muscle. Care must be taken in the performance of this exercise not to stretch, but rather to contract, the muscle around slightly separated fingers; thus ensues a contest of strength between the orbicularis oris and the muscles of the fingers.

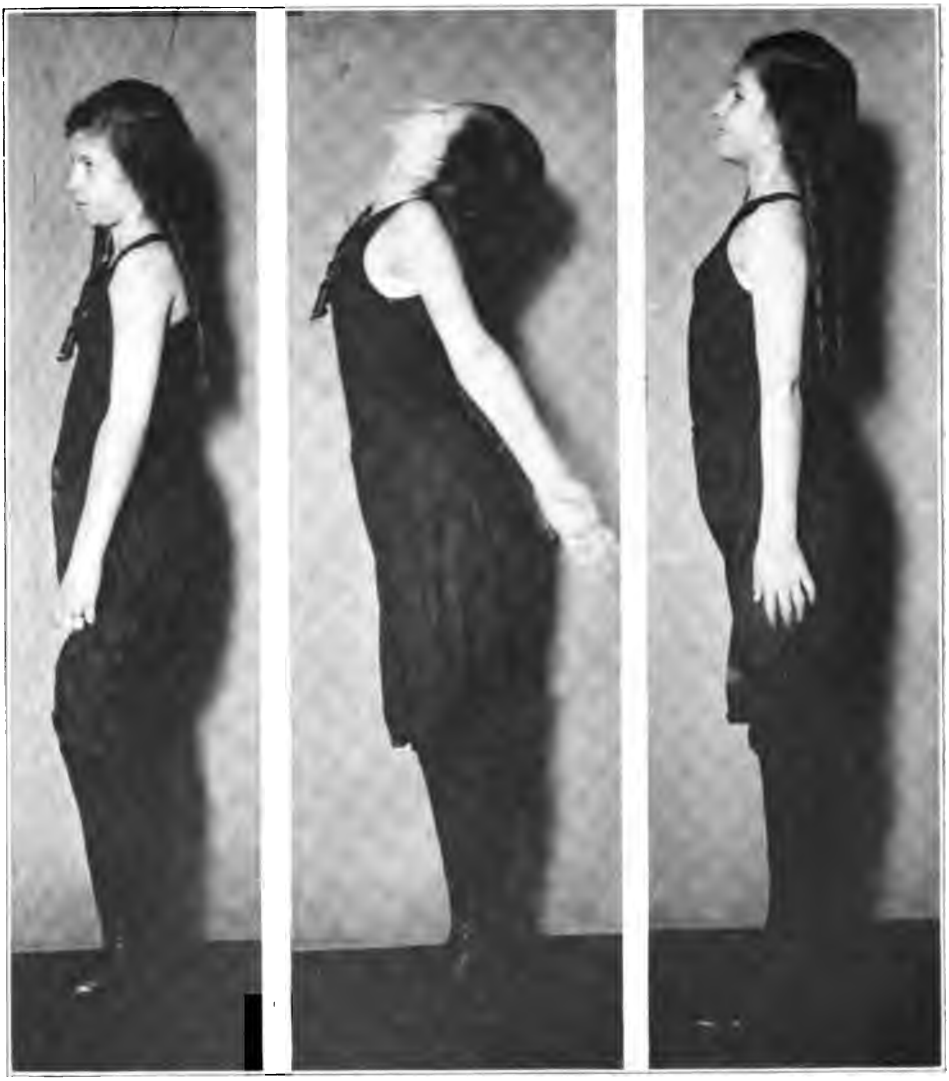

Fig. 18.

It is frequently found necessary to prescribe a tonic exercise, which I have termed the exercise for general facial development. This exercise influences not only the orbicularis oris, but also the buccinator and all the small ribbon muscles which enter into a combination with the orbicularis oris. It consists in the use of warm water at a temperature which is bearable to the mucous membrane of the mouth, and in which has been dissolved a small

portion of bicarbonate of soda. The patient is directed to take a sip of this solution, closing the teeth firmly in position, and with great energy forcing the liquid from the lingual cavity into the buccal. The exercise is usually done five times morning and night. The patient is directed to continue each exercise until the muscles are slightly fatigued. A not unpleasant aching sensation is the indicator of the successful effort. The heated liquid adds a distinct advantage to this exercise, as it has a tendency to dilate the blood vessels, thus producing a more copious supply of nutritive material. At the termination of this exercise, the face will be found to glow with warmth.


Fig. 19.


Fig. 20-*A*.


Fig. 20-*B*.

The platysma myoides is one which, to my mind, is of great importance when considering the correction of faults in the facial muscular development. This muscle has no bony attachments but is inserted in the fascia and skin of the pectoral and deltoid muscles of the chest and upper shoulder at one end, and at its facial extremity is inserted by many fibers into the orbicularis

oris and some of the other muscles upon or near their entrance into the same. It will then be seen that, if this muscle is contracted in its length by the bad posture of the patient, it has a tendency to stretch the weakened muscles of the face in directions which bring gentle but harmful pressure upon the fragile bony structure of the child's face. The exercise for this muscle is found in the general posture exercise illustrated in Fig. 18, which consists in having the patient stand with feet together, hips slightly thrown back, directing the child to look straight to the zenith, at the same time drawing in the abdominal wall and turning the palms of the hands outward, making a slow and positive stretching motion with the tips of the fingers and the point of the chin. The child is then directed to relax somewhat, bringing the head and arms to erect position, then repeating the impulse. This exercise is done at first a few times in the morning upon arising, and a few times before retiring, and is increased until the child is able to do it sixty to one hundred times a day. It is important in this exercise that the child is not allowed to curve the vertebræ so that the back represents much of a concavity. To avoid this, the child is directed, when drawing in the abdominal wall, to tighten, at the same time, the muscles of the buttocks. A slight forward movement of the body, bending slightly at the ankles, thus bringing the weight of the body slightly upon the balls of the feet enhances the position of mechanical advantage in this exercise.

When a child is born, the earnest wish and hope of father and mother is that the child shall represent not only physical perfection, but mental strength as well. But the unconscious child has many an obstacle placed in his way by reason of the malevolent influences of civilized existence. His habits of body and mind, his tricks and manners of speech, the performance of his muscular acts, are allowed to develop without a conscious control. He has about him myriads of people presenting to him for his imitation, imperfect models. The parents very often are the greatest sinners in this regard. And so the subconsciously influenced organism develops more often than not along the road toward ill-health, completely unconscious of his own bodily disadvantages and mental handicap. Our schools struggle with backward children —backward in mind and body. There is some encouragement in the thought that there can be seen at the present time a tendency toward a reeducation both mental and physical.

The child whose picture I shall now show you represents a type which is all too prevalent among the children of today. (Fig. 19.) This child's history will be interesting for brief consideration. It will be readily noticed that not only the muscles of her face are maladjusted, but that there is no evidence of mechanical muscular balance throughout the whole body.

I next invite you to study the double picture of this same child, Fig. 20, after two months' following the instructions that I had given her respecting conscious guidance over muscular activity, together with orthodontic treatment for the correction of the malosseous development of the bones of the face and malocclusion of the teeth. The exercise, which this child has been taught to undergo, consists in gaining control of the pterygoid muscles and

control of the muscles of the trunk, particularly those of the abdomen. The picture showing the great improvement in this child does not represent the conclusion of the treatment, but simply represents the physical condition after two months of conscientious effort. The marked improvement in her physical being has its counterpart in her mental development, also. This was first noticed by the parents when their habitually backward child began to bring home reports of a very different mental alertness. The child's outlook on life has also shown a vast change, and she is learning to use those powers of mind which are responsible for right development physically, mentally and morally. Her obedience to my requests is prompt and earnest. This I have found generally true with all children who are not, by reason of some unfortunate taint, incapable of realizing the benefits which are bound to occur from this rational line of treatment.

The brief history of a few more cases will be interesting to you, I hope. It will be well at the outset for me to say that each of the three cases which I shall now present to you are undergoing treatment along the general lines

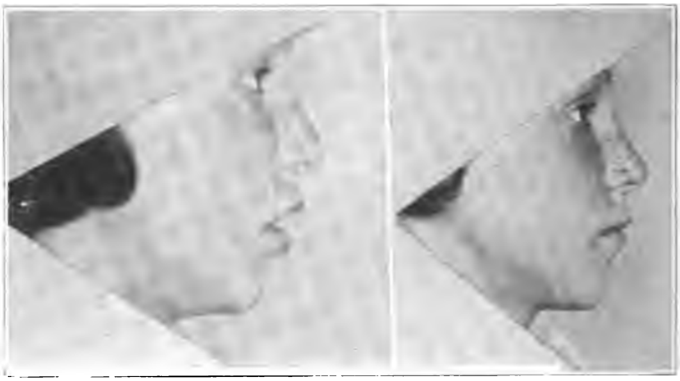

Fig. 21.

which I have indicated. The first is that of the case common in your practice—a child who has been operated upon by a skillful surgeon for the removal of adenoids and tonsils, and who has made the same mistake that the orthodontist has made in assuming that the child somehow or other subconsciously gains control of the distorted and ill-draped facial muscles. The interesting point about this child is that, being a subdivision of Class II, with upper laterals in slightly lingual occlusion, she is being treated without any apparatus whatever, and satisfactory progress is being obtained. The lapse of time between these two pictures, Fig. 21, represents a period of about six weeks. Her distal occlusion is no longer apparent, the muscles of her face are becoming firm and well established in their normal positions.

This is evidenced not only by the improved muscular balance of the orbicularis oris and its attached muscles, but also by the improved contour and the region occupied by the masseter muscle. The exercises which this child is undergoing are the general posture exercise, the pterygoid exercise, masseter exercise, and exercise for the tongue, in obtaining and maintaining the

full development of the lower arch, and balancing the forces of occlusion brought into existence by the control of the masseter and temporal group.

This illustration (Fig. 22) is of a boy eleven years of age, an extreme case of Class II, one of those cases where the persistent use of intermaxillary elastics, followed by a long course of mechanical retention is so often unavailing. The treatment of this case consisted in using the general posture exercise and the pterygoid exercise. Later on, when the muscles had become accustomed to placing the mandible in its normal relation with the rest of the skull, small inclined planes were placed upon the anterior teeth. His future treatment will consist of a continuation of these exercises, with the addition of the temporal and masseter and those of the muscles of expression, including the orbicularis oris.

In Fig. 23, the profile on the left shows a child with slight distal occlusion.

Fig. 22-*A*.

Fig. 22-*B*.

It will be noticed that the muscles around the mouth are poorly developed, and evidently not under proper nervous control. The picture on the right shows this same patient after completion of the treatment. This patient has now very satisfactory muscular development. The figure on the right also shows the improved contour and the more normal nervous control of the muscles of the face. This patient has developed an unusually fine set of masticatory muscles where, when the case was started, these muscles showed very little development. In Fig. 24 the model on the left shows this case before treatment, and on the right the result at the completion of the treatment.

I reserved for your consideration a case (Fig. 25) which has given me much encourgement, and I feel that this child, like the three preceding cases, has been doing and is doing her part in helping to establish the importance of the matter which I have been presenting to you today. They have all four been faithful and earnest in the application of the advice I have been giving them, and their mental alertness and interest have gone apace with their improved mental condition. This child, as you see her, before supplying the

rational treatment, suffered from a severe case of protrusion of both upper and lower incisors. She was treated and retained over a period of several years by a man of unusual attainment in orthodontia, but the muscles were not trained or developed in any way. The difference in time between the first and last pictures represents a period of about ten months, and the satisfactory result with respect to the correction of malocclusion is found in the fact that no mechanical retention has been necessary in order to maintain both the upper and lower incisors in their normal position. The difference in muscle

Fig. 23-*A*.

Fig. 23-*B*.

Fig. 24.

tone and control between the first and last picture has been sufficient for the purpose of retention. It will hardly be necessary for me to indicate definitely the other points of improvement in this face; the more you study, the more nearly it will be seen to approach the graceful, well-poised face that nature intended this girl to enjoy. A contemplation of a side view of this same patient (Fig. 26) representing the same period of treatment, will be found even more interesting than the study of the front view. The muscular improvement will be seen to have taken place in the masseter, submandibular, synthesis, orbicularis oris, and the nose. All these points show marked improvement

upon a casual examination. The improvement in the tone of the muscles evident upon a digital examination, is quite marked.

It will not be necessary for me to go further in order to convince you of the value of these experiences along the line of muscular control in con-

Fig. 25-*A*.

Fig. 25-*B*.

Fig. 26-*A*.

Fig. 26-*B*.

junction with a simplicity in the construction and manipulation of orthodontic appliances.

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THE REMOVABLE LINGUAL ARCH AS AN APPLIANCE FOR THE TREATMENT OF MALOCCLUSION OF THE TEETH*

By John V. Mershon, D.D.S., Philadelphia, Pa.

It is a well-known biological fact that to have normal development of the tissues and organs of the body, we must have normal function of these tissues and organs during the process of development.

Anything interfering with the forces which produce these functions will interfere with the functions, and just in proportion as we have a disturbance of function we will have a disturbance in development.

Malocclusion of the teeth or maldevelopment of the facial bones is quite likely the result of a perversion of or some interference with these functional forces, and the orthodontist is endeavoring to correct these deformities and restore these functional forces with orthodontic appliances. These appliances are effective just in proportion as they apply force in the direction of normal growth, and in so doing do not interfere with the function of any of the tissues associated with the teeth, or with the teeth themselves collectively or individually, each tooth being left free to functionate normally.

The direction of normal growth of the teeth and facial bone are, forward, outward and downward in the upper jaw: forward, outward and upward in the lower jaw.

The appliance in which the application of force is in these directions and which does not interfere with any of the associated functional forces, would be the ideal appliance. I am going to ask your consideration of the removable lingual arch as the appliance which seems to possess many of these qualities.

Occupying a position on the lingual surface of the teeth and at the gingival border, with all the teeth free to functionate normally (except the two molar teeth to which the arch is attached), the appliance develops a force which operates from the lingual side and is in the direction of normal growth, and the muscles of the lips and cheeks are left free to functionate normally.

THE ARCH

The removable lingual arch is a wire of suitable size, to which auxiliary springs can be attached, adapted to the linguo-gingival surfaces of the teeth, and bent to conform to all the inequalities of the dental arch, produced by the irregularities of the teeth. It is fastened to the lingual surfaces of the molar bands by means of the Young-Angle lock with certain modifications. This lock has proved most valuable to the profession, and we are greatly indebted to the developers of it. I have modified it by using a half round tube in place of the elliptical one. The lock is a wire soldered mesial to the tube, instead of being formed by bending the portion of the arch which is distal to the tube to change it gingivally.

*Read before the Eighteenth Annual Meeting of the American Society of Orthodontists, Chicago, Illinois, August 1, 2, 3, 1918.

CONSTRUCTION OF THE ARCH

The arch is constructed on a plaster model made from a good impression, bands having been previously fitted to the anchor teeth (usually the first molars). These bands are transferred to the corresponding teeth on the plaster model, with half round tubes soldered at the proper location on their lingual surfaces.

BENDING THE ARCH WIRE

We start at the half round tube, allowing the arch wire to extend about one eighth of an inch, distally beyond the tube. Just mesial to the tube we make a compound bend in the wire, first to the gingiva, then again bending the wire parallel with the gingiva, and continuing along the lingual surfaces of the teeth, as close to the gingiva as possible, without impinging on the same, adapting the wire to all the irregularities of the dental arch, until the tube is reached on the anchor band on the opposite side, when the arch is cut off one eighth of an inch distal to the tube.

Fig. 1.—Lingual arch bent to conform to the lingual surfaces of the teeth.

LOCATION OF HALF ROUND TUBES ON MOLAR BANDS

The tubes should be placed on the lingual surface of the anchor bands, usually in the center of the band meso-distally in both upper and lower jaws. In the lower they should be placed as near the occlusal edge of the band as possible, allowing only sufficient distance between the occlusal edge of the band and the top of the tube for the arch. This is so placed for the reason that the post is easier to place in the tube if it is not too far toward the gingiva, as it is difficult to see the tube in the lower on account of the tongue and saliva. In the upper jaw, the tube should occupy the same position meso-distally, but should be placed as near the gingiva as possible, otherwise the lingual cusps of the lower molars will come in contact with the arch, and the continuous biting on it will eventually cause the arch to break.

SOLDERING OF THE HALF ROUND POST

The post consists of a half round wire soldered to the arch and accurately fitting the half round tubes forming a portion of the lock.

For convenience in soldering, a long piece of half round wire is selected. Place the arch accurately on the model, mark the arch opposite the tubes, then solder the post to the arch opposite the mark, in the usual free-hand manner, cutting off the half round wire just a little shorter than the tube, leaving a catch for the lock wire. Then place the half round post wire in the tube on the molar bands on the model. If the arch should not lie correctly on the model, remove it, and with two pairs of the Young pliers it can be twisted to the desired position. Proceed in the same manner soldering the half round post wire on the opposite side. The arch is again replaced on the model with both pieces of the half round post wire in the tubes. If the arch should not be well adapted or be raised away from the model, direct the flame of the blow pipe on the arch, heating it to a cherry red, and while hot, pressing with a suitable instrument on the arch it can be readily adapted to the model.

The lock consists of a wire of suitable size, soldered to the gingival surface of the arch, twenty one hundredths of an inch mesial to the half round post, passing it distally to catch under the gingival surface of the tube, thereby preventing the post coming out of the tube. After polishing, the arch is now ready to place in the mouth. Remove the anchor bands from the plaster model

Fig. 2.—Trying in the arch, showing incorrect position.

Fig. 3.—Trying in the arch, showing correct position.

and cement them on the teeth. In trying the arch in the mouth, grasp the arch on the left side in the region of the half round post, with a pair of Howe pliers, and place the post in the tube on the left side. The arch should lie in its proper position, with the half round post on the opposite side parallel with the half round tube. Should it not fit properly twist or bend the arch until it lies correctly (Fig. 2). Remove the post from the tube on the left side, then place post on the right side in the tube. If the post on the left side drops in place in the tube, then the arch is ready to be locked in place (Fig. 3).

MATERIAL AND SIZES

The size of the wire for the arch which has proved most satisfactory is thirty-six one thousandths, or nineteen gauge B. & S. For the lock, twenty-six one thousandths is used. The half round tubes are ten one hundredths of an inch long, and the post wire sixty-four one thousandths by thirty-two one thousandths.

The arch wire should be hard, with a good spring, and sufficiently tough to stand bending and rebending, also to stand stretching with the pinching pliers without breaking. It should also possess the quality of softening by anneal-

ing, and retempering again, and be sufficiently high fusing to stand soldering with a high carat solder. Some of the gold and platinum alloys on the market today possess all these qualities; the half round tubes, the post wire, and the wire for the auxiliary springs, are all of the same material as the arch itself.

THE AUXILIARY SPRING

These springs are wires usually twenty-two one thousandths of an inch, soldered to the main arch wire to produce individual tooth movement.

PROPER LOCATION OF THE ARCH

The arch should occupy a position on the lingual surface of the teeth as close to the gingiva as possible, and made to conform to all the inequalities produced by malocclusion.

THE USE OF THE ARCH

I shall only consider treatment in so far as it consists of general arch development, and tooth movement in the individual arches.

The arch when first placed in the mouth should be passive, the patient being allowed to wear it long enough to become entirely accustomed to it which is usually a week.

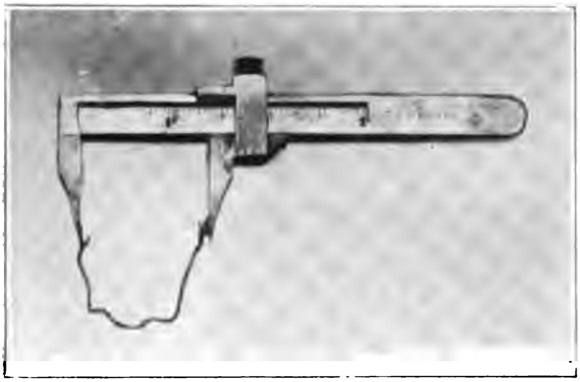

Fig. 4.—Illustrating method of measuring with Hawley calipers.

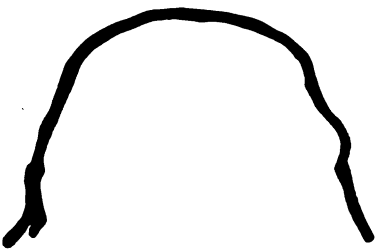

Fig. 5.—Showing arch after kinks had been taken out. Same arch as in Fig. 1 with bends taken out.

During this period children are more likely to play with the arch with the tongue, or fingers than thereafter. Therefore, very strict caution should be given both patient and parent regarding this evil, as well as against eating sticky candy. After these precautions, I seldom have trouble, but should I have trouble at the next visit I fasten the arch with a fine ligature wire to some favorable tooth and this usually cures the trouble after the patient becomes accustomed to the appliance. I seldom find it necessary to band teeth to keep the arch in place.

TREATMENT

The force necessary to produce tooth movement with the lingual arch is obtained in three ways. One by straightening out the inequalities in the arch

wire; another by auxiliary springs soldered to the main arch; a third by stretching the wire by means of the wire stretching pliers.

After removing the arch from the mouth the procedure of adjusting it consists of taking a measurement of your arch from one post to the other (Fig. 4). This is most important, and is best accomplished by a pair of measuring calipers such as Dr. Hawley used with his charts.

After this is done, retain the calipers for measuring before replacing the arch. I have above stated, the arch must conform to all the inequalities produced by the irregularities of the teeth which necessitates a great many bends and curves in its length. We now proceed to take some of the bends and curves out of the arch (Fig. 5). This is best accomplished by a suitable pair of flat-nosed pliers. Each time you remove one of the bends or curves the

Fig. 6.—Same model as Fig. 1 after 15 months' treatment.

Fig. 7.—Spring method of rotating upper first bicuspids. *A*. Showing springs in position. *B*. Showing results of two treatments.

size of the arch is increased. When you replace the arch, by placing the posts in the half round tubes there is a general forward and outward pressure on all the teeth, that require moving outward or forward (Fig. 6). Your object at each treatment is to conform the lingual arch more nearly to the shape you expect the dental arch to be when completed. It is astonishing how little change is required at each treatment. As you straighten out a curve which was toward the lingual to conform to a tooth that was lingually placed, on replacing the arch the most pressure naturally comes on that tooth, and it is in this way that we obtain an outward pressure. After making the adjustment in the arch, before replacing it in the mouth, always measure across from one post to the other with the calipers with which you have previously measured, and set, noting that you have made no change in this region, unless you wish expansion of the molars. After making this change in the arch, it is interesting to note

that when replaced in the mouth and locked into position, the arch will push a little harder on the teeth you wish to move into the line of occlusion with a beautiful reciprocal force. Continue in this manner from time to time, either broadening or lengthening the arch or both as desired, until the teeth have been moved to their desired position.

AUXILIARY SPRINGS

These springs are usually soldered to the gingival side and at right angles to the main arch, and are then bent in the direction in which you wish to apply force. The reason for soldering the springs at right angles to the arch and bending them is, that in soldering, the high heat removes the temper from the wire, while the bending to correct position restores the spring temper. The general developing and shaping of the dental arch is best accomplished by the reshaping of the main arch.

Individual tooth movement is best accomplished by the individual springs

Fig. 8.—Showing rotation of cuspid without bands by the use of auxiliary springs. *A*. Original model. *B*. Showing cuspid rotated.

Fig. 9.—Front view of Fig. 8.

ROTATIONS

For rotation without banding the teeth let us take as an example the upper first bicuspid which frequently erupts with the lingual cusp rotated mesially (Fig. 7). This is very easily corrected by soldering a spring to the main arch, opposite the approximal space between the first and second bicuspid. Bend the wire mesially forming a half circle, with the free end of the spring wire engaging the first bicuspid with pressure on the mesial surface opposite the lingual cusp.

The spring wires are quite long and you can give a good deal of spring to them, and on account of the small gauge of the wire it will be a very gentle force, effective for a long period of time, often as much as two months.

Rotated cuspids can in many cases be corrected without banding the teeth. Allow the lingual arch to rest with slight pressure against that angle of the tooth which is rotated toward the lingual (Fig. 8). At this point solder

a wire spring pointing occlusally, bending the spring wire labially to pass between the cuspid and the adjoining tooth, and continue the bending toward the gingiva, allowing the loose end of the wire which has been properly shaped therefor to engage with pressure the labial portion of the cuspid which is rotated labially. (Fig. 9.) A large proportion of such rotations can be corrected in this way.

A method employed where the case can be seen infrequently is to band the tooth to be rotated in the usual way, with a spur attached to the labial side of the band, (Fig. 10). A spring wire of twenty-six one thousandths is soldered to the arch some distance from the tooth to be rotated and the spring is bent almost parallel with the main arch. On the loose end which should now stand some distance from the arch, place a fine ligature wire, which passing through

Fig. 10.—*A.* Showing auxiliary springs for rotations when a case can be seen infrequently. *B.* Showing result after being wired once and allowed to remain a number of months.

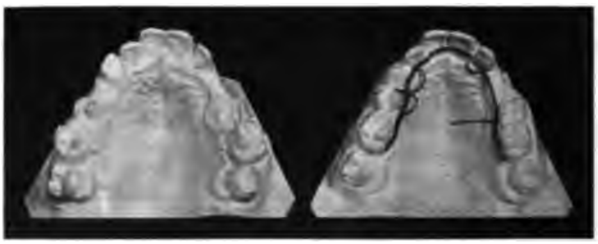

Fig. 11.—Method of opening spaces with auxiliary spring. *A.* Showing spring in place, with the straight one showing how they should be soldered before bending. *B.* Showing result of treatment.

the gingival space, engages the spur on the band. After this the ligature wire should be tightened until the spring is in contact with the main arch. It is well to make a bend at the end of the spring wire so the ligature will not slip off. The tendency of the spring wire to return to its original position will cause the tooth to turn on its axis.

ANTERIOR ROTATIONS

To rotate central and lateral incisor teeth, use a grass line by ligating the tooth, then passing one end around the arch and back through the gingival space tying the two ends firmly together. The contraction of the grass line will cause the tooth to turn. In younger cases the lingual arch will frequently correct a rotation of the anterior teeth, simply from the light pressure of the arch resting on the corner of the tooth rotated lingually.

The lips being free to functionate are pressing on the labial portion of the same tooth and are assisting in correcting the rotation.

ROTATION OF THE FIRST MOLARS OR ANCHOR TEETH

Of all the teeth, the correct rotation of the first molars I consider the most important. When they are used as the anchor teeth, this is easily accomplished by making a very slight bend in the arch wire where the half round post is attached. The molar roots or crowns can also be tipped buccally or lingually by grasping the arch mesial to the post with a pair of Young Pliers. At the same time with another pair of pliers grasp the arch where the post is soldered to the arch,

Fig. 12.—*A*. Showing auxiliary springs for labial movement of laterals, one in correct position, the other just before bending in correct position. *B*. Showing result of treatment.

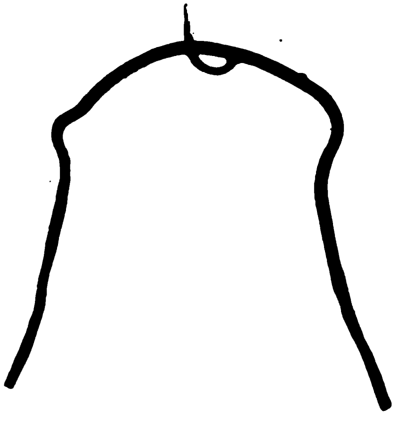

Fig. 13.—For mesial or distal movement of anterior teeth.

Fig. 14.—Auxiliary springs for lateral development in deciduous denture.

giving a very slight twist in the direction you wish the movement, caution always being taken that you do this exceedingly slowly or you may cause your anchor teeth to loosen. This precaution should be taken at all times in using the lingual arch, as it is very easy to place great strain on your anchor teeth.

To overcome this it is wise to solder a spur on the arch to engage the mesial surface of the first bicuspid. This greatly relieves the strain on the molars, as you can increase or diminish the pressure of the spur at will.

TO OPEN SPACE FOR IMPACTED TEETH OR MISSING TEETH

This is accomplished by two auxiliary springs, soldered to the arch, one the width of a tooth distal to the place you wish the space, the other the

width of a tooth mesial to the space, making the two springs the width of two teeth apart. The one most distal curves mesially to engage the one tooth, while the mesial one curves distally to engage the other tooth. (Fig. 11.)

The spring should always be soldered at right angles to the arch before bending into the half circle.

With the loose end of the spring flattened by disking the sides, this end usually passes to the gingival side of the arch to engage the teeth.

LABIAL MOVEMENT OF TEETH

To move laterals labially a spring is soldered to the arch, opposite the median line, then bent to the right or left to engage with pressure the lingual surface of the lateral that is to be moved. (Fig. 12.) To move the anterior teeth mesially or distally, solder a spring to the arch about fifteen one-hun-

A. *B.*

A. *B.*

Fig. 15.—Showing case before and after treatment. *A.* Original model. *B.* Same model and arch after treatment.

dredths of an inch distal to the tooth to be moved. (Fig. 13.) Bend the spring in a curve passing the loose end, which should always be flattened by disking both sides until it is very thin, to the gingival side of the arch, and if properly adjusted (this is most important in all of the auxiliary springs) it will pass between the tooth and the soft tissues at the gingival space in the same manner as a thin band. Tooth movement is very easily accomplished if slight pressure is applied to the tooth by tightening the spring from time to time.

The auxiliary spring is very useful with the deciduous denture where we are desirous of obtaining lateral development from one deciduous cuspid to the one on the opposite side. (Fig. 14.) Adapt the arch to the lingual surfaces of the teeth, soldering springs on both sides to the gingival side of the arch, as near the lock as possible. Bend each spring wire parallel with the

arch to engage the deciduous cuspid by flattening the end of the spring and bending it toward the gingiva to fit around the linguo-gingival ridge of the tooth. With the proper adjustment of the springs the desired development can be obtained.

One very interesting feature of the lingual arch is that in moving teeth you seldom have tipping of the teeth, and when you do it is very slight; that is, unless you have been unwise and hurry your work faster than normal development.

The reason the teeth do not tip probably the fact that the arch occupies a position to the lingual of the teeth at the gingiva, pressing forward or outward or both as you desire, with the lips and cheek muscles left free to functionate normally, and every contraction of these muscles causes pressure on the incisal edges of the teeth. Every tooth left free to receive the normal occlusal impact during mastication, produces a normal functional bone development causing the teeth to be carried bodily forward.

In a great many cases the amount of wire from one half round post to the other is just the amount desired. (Fig. 15.) If it should not be sufficient, the one-eighth of an inch that extends beyond the tubes can be utilized by unsoldering the post and resoldering as far distal as necessary to give the de-

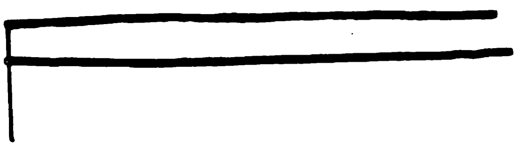

Fig. 16.—Arch wire in case in Fig. 15, lowers straightened out, showing difference in length of wire from distal surface of first molar on the completed case, and the case when started, showing how much is gained in length by straightening out the loops.

sired length of arch. (Fig. 16.) If for any reason this is not sufficient, or in case of a broken or lost arch, take an impression in modeling compound which will show the tubes, and a new arch can be made very quickly, and by slight adjustments in the mouth can be fitted nicely.

RETENTION

My conception of orthodontia is that we are not only trying to restore teeth to what we have termed normal occlusion, but to restore the tissues and organs which constitute the oral cavity to normal function. From the time you start to treat a case of malocclusion with the lingual arch, until it is finished, it might be considered a continuous retainer, as it interferes so little with normal functions, and is constantly assisting in the development of these oral tissues in the direction of normal growth where nature has failed.

This paper is by no means a complete analysis of the removable lingual arch, but is only intended to show that tooth movement can be produced.

I have not touched on its use in connection with the labial arch, or by the use of the wire-stretching pliers, as this has been so ably presented by Doctor Lourie.

THE LAW OF OCCLUSION AND THE NORMAL IN ORTHODONTIA*

A Philosophic Survey of Recent Tendencies in Orthodontia in the Light of Science

By A. LeRoy Johnson, D.M.D., Springfield, Mass.

In modern orthodontia there has developed a tendency to absolute methods and absolute claims as to the results of treatment. And it requires no violation of reason to see in such methods the logical extremes of the doctrines upon which orthodontia was founded. With its inception in mechanical dentistry during that period of philosophic thought when diversity of form was entirely attributed to environmental influences such conclusions as the following were natural. They are the dominance of the mechanical influence of cusp relation in the development of occlusion; the inherent tendency of all organisms to evolve a definite type, harmonious in design, and the equal potentialities of development of all organisms. In the light of advancing science, and a deeper knowledge of the forces governing occlusion derived from practice we can no longer allow such doctrines to pass unquestioned even though they still express an element of truth.

The masticatory apparatus is a living part of a living thing and so is subject to the same general laws as are other parts of the organism. Hence the knowledge of its growth and development and the interpretation of such knowledge in terms of practical utility must conform to the methods and material of science in general.

The following is an attempt to express in terms of science the fundamental principle of orthodontia and the nature of the normal as it refers to the species and to the individual. In the subject matter is embodied a criticism of the doctrines referred to above.

The line between common knowledge and scientific knowledge is not easily drawn. To say that science is organized knowledge is not enough, for the commonest acts of everyday life are in greater or lesser degree organized. It can not be said that science is the more exact for much common knowledge is exact. Common knowledge may be just as precise as scientific knowledge but in order that it be scientific it must be precise. Science reduces other knowledge to the same degree of precision. From one point of view science may be called an extension of preception by means of reasoning. It is prevision. A child who knows that a lighted match thrust into water will go out, and the astronomer who, having calculated a transit of Venus, can delineate the black spot entering the sun's disc, do the same thing. Each has a preconceived impression of what will happen upon fulfilling certain requisite conditions. The difference is in the complexity of the process to see the result.[1] In

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reality it is a difference in degree only. One is merely an extended and perfected form of the other. Science defined is knowledge which has been systematized and formulated with reference to the discovery of general truths or the operation of general laws. Science exists because in order to foresee the result of a complex process it is essential that the knowledge referring to this process be arranged in conventional form.

The material of science is accumulated as the result of observation, comparison and experimentation and the methods employed are referred to as either qualitative or quantitative. The prediction that a piece of lead is heavier than a piece of wood of equal size, is the qualitative method. It exhibits certainty but not completeness of foresight. On the other hand, the prediction that water will freeze at 32° F. shows foreknowledge not only of the effect to be produced but of the magnitude at which the effect will be produced. This illustrates the qualitative and quantitative methods combined. The quantitative method applies a definite measure to phenomena as in the use of thermometers, scales, dynamometers and as in the modern methods of experimental analysis. Hence, only in proportion as knowledge becomes quantitative is it especially scientific. Only in the degree that it is measurable is it scientific in the highest sense and do its previsions become complete as well as certain.

From another aspect passing from qualitative to quantitative is passing from inductive science to deductive science. Inductive science is qualitative; it is reasoning from the individual to the universal. Induction gives general principles derived from the observation of individuals as in the formation of a natural law. Deductive science is quite the opposite from inductive science. It is reasoning from the general to the individual. Deduction gives explicit knowledge, it measures. Although deductive and quantitative methods are not coextensive all quantitative prevision is reached deductively. The first stage of all science is inductive but after continually applying this method with constant results, deductively the results of observation may be approached. The history of physiology and morphology shows many instances of the legitimate use of this method. The knowledge of the presence of the vascular and nervous system was inductively established and from this it has been possible to draw certain general deductions.

Thus do common knowledge, qualitative and quantitative science stand in the orderly sequence of their evolution. It is essential to grasp the significance of this sequence and also the distinction between qualitative and quantitative methods of scientific work. The quantitative work that has been done during the last quarter or possibly half of a century has upset many of the philosophical generalizations expressed even now in orthodontic literature.

From the definition of science it is clear that the selection and utilization of knowledge in each branch of science is determined by its relation to the general truth or law which gives to a particular science its distinctive character. In short all science is founded upon a general truth or law. In organic science the basic principle is referred to as a natural law.

A natural law or law of nature means nothing more than that there exists a uniformity in a certain phase of natural phenomena. It is the result of

inductive or qualitative study, i. e., from the observation and comparison of many individual cases there is evident a certain uniformity of phenomena. In the words of Herbert Spencer, "A natural law is the uniformity seen in the diversity of organic forms."[2]

Now, orthodontia like all other branches of science is founded upon a general truth, a natural law. As a result of the study of many organisms, from the observation and comparison of the growth and development of the masticatory apparatus of the individuals of many species there is seen to be a certain uniformity of phenomena. From the viewpoint of inductive reasoning and as a result of qualitative study the order of sequence of the phenomena is seen to be so invariable under normal conditions that a uniformity is readily recognized. And since the mechanical relation of the occlusal inclined planes of the teeth, typical for the species, is the goal of the growth and development of this part of the organism, the uniformity, the natural law (manifest in the growth and development) we call the law of occlusion. Therefore, the law of occlusion is the general truth, expressing a uniformity seen in the diversity of organic forms, upon which the science of orthodontia is founded. It is the basic principle about which the knowledge of the growth and development of the masticatory apparatus, the subject matter of orthodontia is systematized and formulated into a science.

It is not an uncommon procedure in practice to confine the study of the orthodontic case to a consideration of the occlusal relations of the teeth. A concept called normal occlusion is the measure laid upon each individual case and as the occlusal relations depart from this normal occlusion the teeth are said to be in malocclusion requiring treatment. To arbitrarily determine the ideal relation of each individual inclined plane and then, by virtue of the plastic nature of bone, to mechanically conform all variations to this ideal relation, is, like many half-truths, beautifully simple. And in this comparatively easy way the question is often disposed of.

The obvious unsoundness of such procedure is further emphasized in the diversity of opinion manifest in the literature as to the idea conveyed by normal occlusion. To some it is a concept derived from the study of dead forms, prehistoric skulls and lower species; a purely mental concept, a hypothesis, when applied to modern man. To others it is a condition of greatest occlusal contact for the individual case while a few consider normal occlusion as synonomous with natural occlusion. However, the latter do not confine their exposition to that which is typical of the species.

This confusion of ideas is due to a loose interpretation of terms and to the fact that studies of harmonic conditions of development have been limited almost entirely to organisms of a different nature or living under different conditions from the human organism of today. The conception of the normal has not been the result of evidential reasoning according to scientific standards.

What then is the meaning of the word normal? As the term is used in different branches of science slight variations in sense, appear, according to the nature of the material it is expressive of, and, also, as emphasis is put upon the words chosen to convey its meaning, as rule, standard, model, type

or pattern. In chemistry normal denotes a solution of definite character; in geometry normal refers to any perpendicular line; in economics normal and natural are often used synonymously but the use of the word natural invokes certain metaphysical assumptions which are not connoted by the term normal; in biology normal is the balance of activity, growth and repair. Although the word is used differently in the different sciences, in each science its use conveys a definite idea. So in orthodontia where the word normal plays such a vital role in terminology it is essential that it be used in as restricted a sense as possible.

In Webster we find that normal "is according to, constituting or not deviating from an established norm" and that a "norm" is a rule or authoritative standard. As used in the organic sciences normal is according to, constituting or not deviating from a standard or rule which is observed or claimed to prevail in nature. The normal then is not synonymous with natural; it is a standard derived from a study of the natural.

Then if normal occlusion is to be a scientific guide in orthodontia, it must be a standard derived from a study of natural forms. Moreover it must be a standard derived from a study of natural forms as manifest in the human masticatory apparatus as it lives today in the 20th century. It is not a standard derived from the study of fossil forms, prehistoric skulls and lower species. A knowledge of such material is included in that larger concept the law of occlusion, and is necessary to an understanding of the phenomena encountered in the study of the human denture. But the material which determines the standard, the normal, which is to be taken as a tangible guide in diagnosis must be derived from the material we work upon.

The condition of the organized world is not a fixed condition; it is constantly changing. The man of today is not the man of yesterday. Changed conditions of living have caused some parts and organs to become less essential to existence. Until as Bateson says "We, animals, live not only by virtue of, but also in spite of what we are. Any instinct or organ may be of use; the real question is of how much use it is."[3] In view of the diversity of form manifest in the human masticatory apparatus we may well question "of how much use it is." Do not misunderstand me. I do not infer that normal occlusion is not essential but that in the life history of the human organism and the present condition of its denture there is evidence of its not being as vital to existence as it was and is to those organisms from which the popular conception, the old orthodox ideal occlusion has been derived; the same conception that has been responsible for the belief in the dominance of the mechanical influence of cusp relation in the development of the dental arch. It seems quite obvious then that the conception of normal occlusion, typical of the species, as a scientific guide must be the result of the study of the masticatory apparatus of many human beings, living in states of health under the complex conditions of modern civilization. It is a standard derived from statistical investigation.

Today the most conservative thinkers do not question the natural tendency of all organisms to vary. The structural relations of one are not identi-

cal with those of another. Hence in orthodontia we are forced to believe that the normal occlusion for the species, i e., an average typical condition of cusp relation, determined by statistical investigation, and the normal of the individual are not necessarily the same. In the majority of cases we may reasonably expect to find a natural difference between the species normal and the normal of the individual. And thus we are led to one of the most momentous questions of orthodontia, to determine the normal of the individual, to ascertain the range of variation from the normal of the species which is consistent with the most complete realization of the growth and developmental possibilities of the individual organism as a whole. A definite solution of this problem is not anticipated in any instance, in fact the absolute claim is unwarranted. But because now it seems hopelessly beyond our reach is no reason why we should not face the facts of science, utilize its available material and conform our efforts to its methods.

To determine the normal of the individual is a difficult problem. It involves the consideration of phenomena fundamental in organic life. And a scheme of investigation or system of diagnosis which will indicate the individual normal and so in a degree at least anticipate the possible and the impossible in treatment, must be built upon a knowledge of normal and pathological processes as they are expressed in growth and development. We can not postulate the role of pathology as an etiologic factor of malocclusion until we are familiar with normal processes. These latter include such fundamental problems of biology as the interdependence of function and structure; variation and adaptation; heredity and the unity of the organism as a whole. In the material of science relating to these so-called normal processes the individual element in the organism is clearly emphasized.

From the viewpoint of philosophy the life of the individual organism is a continual balancing of external by internal forces. Fisk says, "that it is the continuous adjustment of internal to external conditions."[4] Spencer expresses the same thought in different terms. Thus each consider two kinds of equilibration briefly designated as internal and external. Fisk referring to the internal processes says "we see that direct equilibration which consists in continually arranging all the units of the organism in accordance with their physiologic polarities, exemplified alike in heredity and in the correlation of growth. The dwindling and final evanescence of organs which are disused is due to the fact that the nutritive material is all needed by the other organs which are in constant use." Here Fisk foreshadowed in philosophy the research work of recent years in the necessity of considering the organism as a whole in the endeavor to determine the normality of any of its parts. Philosophically considered a normal individual organism is one expressing an adjustment of internal to external forces consistent with the most complete growth and development of the organism, as a whole. Certain organs develop and atrophy to maintain this equilibrium.

In studying the question of the individual normal it is of particular interest to note the change in the attitude of science to the problem of adaptation, and to follow the investigation in physiologic chemistry and heredity.

For several decades after Darwin the literature was filled with philosophical speculations relative to the phenomena of adaptation. Students of evolution found the study of it so much more interesting and impressive than that of specific diversity that they seem to have seen nothing else. However, during this period very little progress was made. And it was not until the introduction of experimentation on the basis of the quantitative method by the school of experimental biologists headed by Jacques Loeb that definite progress was made.

Approached from a new angle the problem of adaptation appears in a very different light. Loeb says "that authors have too often spoken of adaptation to environment where environment was not responsible for the phenomena."[5] And "while it is possible for forms with moderate disharmonies to survive, those with gross disharmonies can not exist and we are not reminded of their possible existence. As a consequence the cases of apparent adaptation prevail in nature."[6] In another place he says, "Those organisms live and develop that are free from the grosser type of disharmonies; the rest are doomed on account of a gross lack of harmony of the parts. Those latter we never see and this gives us the erroneous conception that harmony or design is the general character of living matter."[7] In his work "The Organism As a Whole" the evidence and references are clearly set forth from which the conclusions as to the lack of design in living nature are derived.

In the work upon the internal secretions physiologic chemistry is applying direct and penetrating methods to biological problems. Mathews says:

"The body is an organic whole, and these so-called organs of internal secretion are not unique, but the bones, muscles, skin, brain, and every part of the body are furnishing internal secretions necessary to the development and proper functioning of all the other organs of the body. Such a scheme to be complete must embrace every organ; only the barest beginning has been made in this study, so important, so necessary for the understanding of development and inheritance. The problems of development and inheritance can not be solved until these physiologic questions are answered."[8]

It is claimed to have been demonstrated that what has appeared as adaptation when unknown has turned out to be a result of the action of a definite chemical substance circulating in the blood. Leo Loeb observed that "the corpus luteum of the ovary gives off a substance to the blood which alters the tissues in the uterus in such a way that contact with any foreign body induces the same decidua formation as does the egg." Steinach has shown that "the wonderful mating instincts seem to be due to definite substances secreted by the sex glands."[9] Lewis has shown "that if the optic cup is transplanted under the skin of a young larva into any part of the body the skin in contact with the optic cup will form a lens; it looks as if a chemical substance from the optic cup were responsible for the formation of the lens."[10]

In the work of the mutationists and students of Mendelian heredity there is evidence that disharmonic conditions of development may express alterations in the hereditary constitution. In the *Scientific Monthly*, May, 1918, Morgan says:

"A specific gene may be essential to the normal development of a certain

organ, which organ through an internal secretion may affect other parts of the body, or even the body 'as a whole.' If, for example, the development of the thyroid gland were known to be dependent on the presence of a certain gene (amongst all of the others involved in its formation) a change in the postulated gene leading to the arrest in the development of the thyroid gland would, owing to the lack of a sufficient amount of some internal secretion of that gland, produce a malformed child with all of the various stigmata of the cretin."

If this is true then the factors of heredity can not be eliminated even though the phenomena directly responsible for the development of a deformity can be traced to the abnormal activity of a ductless gland.

It is neither necessary nor wise to accept in detail the conclusions of any one man or class of men in an attempt to establish a scientific truth In experimental biology it is never certain that all conditions are constant except the one being studied. Consequently it is quite a common circumstance for two investigators of ability to arrive at conclusions diametrically opposed. Furthermore, it is always difficult to determine the value of evidence and particularly so when the alleged phenomena are of exceptional significance. The criterion of science in its three phases, observation, comparison, and experimentation is not always applicable in the study of the life phenomena of the human organism. Hence, the best that we can do in many instances is to apply the "test of inconceivability" to the evidence presented; believing things when we must, but not before.

However, from the most conservative standpoint of accepted scientific thought the doctrines proclaimed in the early days of modern orthodontia are now known to be inadequate. The evidence of science is explicit that the masticatory apparatus is a dependent and living part of a living organism; that it is controlled in its growth and development by the same factors which control the growth and development of the organism as a whole, and that it is expressive of both physical and psychical phenomena. We can no longer assume that all individuals possess equal possibilities of development. "Studies in modern genetics are emphasizing the immense, the overwhelming importance of heredity, in both phylogeny and ontogeny." (Conklin.[11]) And it must be remembered that the directing and guiding factors of development are present in the organization of the germ cell, while environmental factors exercise a stimulating, inhibiting and modifying influence on development. Heredity fixes the possibilities of development; it sets bounds beyond which we can not pass. Nor can we assume the inherent tendency of all organisms to evolve a definite type, harmonious in design, in the face of evidence of natural disharmonic development and the possibility expressed upon good authority that such disharmonies may in rare instances be of the character of hereditary mutations.

The relative importance of heredity and environment is not the same in the development of man as in the development of the lower animals; environment plays a larger influence because of the longer period of development while heredity plays the same part as in the lower animals. Although most deformities are considered as the result of extrinsic, environmental forces the nature of the condition can not be known without taking heredity as well as environment

into consideration because the character of a response to stimuli is determined by the organism. The forms which structures take on are not the result of either environment or heredity working independently. Conklin says, "We do not inherit disease but the factor which determines whether one organ is susceptible to a disease while another is not, may be an inherited factor."[12] Form development is the result of the interaction of forces determined by heredity and environment. Hence the etiologic factor of malocclusion is that which affects the organization of the organism or modifies the stimuli of the environment sufficiently to disturb the equilibrium expressed in normal development. A certain mechanical influence which will bring about a modification in the structural formation of the dental arch of one individual will not necessarily bring about the same arch formation in another individual. In each case we are face to face with the individual element.

The problem of orthodontia is a complex one. Founded upon the law of occlusion and concerned with the development of the dental arch of the individual organism it involves the most fundamental problems of biology. A conception of orthodontia limited to the mechanical relations of tooth forms, while alluring in its simplicity and the promise of the absolute, will not withstand the crucial test of practical utility, since it ignores the essential vital activity of life phenomena.

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DISCUSSION ON THE PAPERS OF DOCTORS ALFRED P. ROGERS, A. LEROY JOHNSON, AND JOHN V. MERSHON.

Doctor Hugh K. Hatfield.—One of the most striking things about these three papers, it seems to me, is their completeness in sequence. Doctor Johnson emphasizes the fact that there is a normal for each individual, and that this may vary widely from the average or normal for the species or race, and that the ideal of a perfect arrangement of teeth to give absolute occlusal contact may or may not exist in this present day.

He makes it clear that the individual normal must be determined by a consideration of other factors than tooth form. He shows the importance of studying, not so much the models, as the case histories of each individual by every aid science possesses, realizing that in the complex interrelations which the body presents in such a function or organ, we are dealing with a set of processes entirely without parallel in the inorganic world. To still hold that a shoulder to shoulder arrangement of contact points and a more or less perfect interchange of stimulating force through the occlusal planes, is the sole maintaining force is folly. He urges a greater study of quantitative measures and a more comprehensive, intelligent and exact use of statistics that more light may be thrown on our subject. Some one has said that "nothing is fully known until it can be expressed mathematically." To mention one unknown quantity, do any of us know yet the relative frequency of this condition of malocclusion?

Doctor Rogers and Doctor Mershon have both presented extremely interesting forms of treatment. Doctor Rogers has demonstrated the manner in which a physiologic effort is made to bring out the development possible in each individual child, a better muscular tone, a very potent factor in maintaining built-up bony structures. This is the functional factor, the constructive agency in form development, but the inherited element in the organism must determine the possibilities of development.

Doctor Mershon has shown the simplest possible artificial means of stimulating and changing the alveolar structure in our effort to aid nature in development interfering in the least with physiologic activity of the parts.

Too much unpractical and unscientific theorizing in the clinical field has made our specialty top heavy, and to keep our foundations solid and commensurate with the superstructure, is one of our problems today.

Doctor Calvin S. Case.—Mr. President and Gentlemen of the American Society of Orthodontists: The very interesting paper by Doctor Johnson which I was to discuss before your society, has at last been placed in my hands.

I find upon a careful reading that it is a difficult paper to discuss, because there seems to be no definitely stated conclusion or proposition relative to the principles or practice of orthodontia. This leads me to fear that I will make a wrong interpretation of the essay in its discussion.

It is certainly interesting in the sense that it conclusively proves that the practice of orthodontia is the one branch of dentistry which leads investigating minds to realize the needs of a more or less familiar understanding of the principles of biology, and particularly the laws which remotely or otherwise have led to many dental and dento-facial malocclusions.

This subject (if I may be allowed to introduce a personal equation) was pretty thoroughly thrashed out in a paper and its discussion, entitled "The Question of Extraction in Orthodontia," read before the National Dental Association in 1911.

The practice of orthodontia also must lead to a higher appreciation and study of facial art, now that the possibilities and opportunities of correcting the facial outlines in deforming protrusions and retrusions have been greatly increased by the somewhat recent acceptance and practice of "bodily movement."

I have wondered if it were not the main object of the essayist to give a warning to those orthodontists who were still following the arbitrary cut and dried mathematical rules of practice, oblivious of individual demands. It is not strange in my opinion, that many orthodontic specialists at one time were permeated with misleading beliefs in regard to occlusion and malocclusion of the teeth, as the essayist has intimated, and of which it is not a far cry to say was because they were fed like birds with open mouths on a cir-

cumscribed quality of false pabulum, outside of which all other teachings were *verboten,*

It is refreshing to see such manifestations as the paper presents toward the awakening to broader knowledge founded upon established principles of scientific thought. While I can not quite see the practical application of the lengthy scientific and philosophic dissertation apparently to define the meaning of science and how it differs from common knowledge, and to prove that normal occlusion of human dentures arose like other grand and perfect anatomical culminations through the natural forces of nature, I have no doubt the essayist had a certain purpose in view which may be that he felt the need of showing that the laws and teachings of science should be regarded as a dependable foundation upon which we may fearlessly rely, and feel at liberty—though it may not be what we were taught—to open our eyes and look out on the world of other thought and other teaching, and if desired may take long and much-needed draughts from nature's fountains, abundantly supplied upon every hand from the pens of eminent interpreters.

I think he endeavors to show that the equilibriated occlusion of the human dentures, known as normal occlusion, is not the ideal occlusion which formed so large a part of the earlier writings and illustrations of orthodontists, any more than physical forms of the human race individually follow the type of the Apollo Belvedere, but that it differs within the limits of its standard as people differ. Moreover, I believe it is generally conceded by scientific men that the inherited standard of dental occlusion has come down to us essentially unchanged through the ages from the prehistoric men of the old stone age, and kept in line through the law of natural selection (survival of the fittest), and its perfect adaptation to needs.

Even as far back as the "second interglacial period," 200,000 to 350,000 years ago, the forms, number, and relative position of the teeth and their occlusion was essentially the same as the standard normal occlusion of today. And though in the earlier stages of that vast period the jaws were of a heavier type, and the bi-maxillary protrusive prehensile mouths, enhanced by chinless mandibles, showed their distant descent from their anthropoid progenitors, the occlusion of the buccal teeth, their alignment and arch form—even the canines which had thrown off nearly all their carnivorous characteristics—were all practically the same as today. I speak of this because the essayist infers that the normal occlusion of modern man differs from that of the prehistoric.

I am pleased to refer those who are interested in this department of science to a recently published work entitled "Men of the Old Stone Age," by Prof. Henry Fairfield Osborn of Columbia University and U. S. Geological Survey.

In our strife to produce the highest possibility of our specialty by the accomplishment of the greatest good to humanity, if we are to regard this normal occlusion as a scientific guide in orthodontic practice in the same sense that health is the scientific guide in the practice of medicine, I am loath to believe that the essayist or any one having the intelligence and higher sensibilities of humanity can wish us to exclude from our view the increasingly appalling number of dento-facial deformities which the attainment of a normal occlusion can not possibly correct, and which appeal to us upon every hand for succor which we can so easily give, and too, with it an occlusion that is equally useful and often with greater chance of permanency of retention.

Many of the most strongly marked dento-facial malocclusions have arisen through the same biological forces of heredity that characterize the normal and relatively harmonious, but unfortunately through unions of inharmonious types on the principle of hybridizing, and from other sources, closely related physical disharmonies are frequently stamped upon individuals whose psychologic influences mar their entire lines, and whose beautifying correction from an artistic standpoint demands changes which should not be held subservient to the "law" of an idealized normal occlusion.

Doctor Alfred P. Rogers.—Where it bears relation to Doctor Johnson's suggestions my paper might be considered as a discussion of his. However this may be, I should like to add another word. Doctor Johnson has treated his subject in a philosophical manner. I believe that there are few of his hearers who would be able to comprehend the absolute depth of his reasoning until they have had opportunity to make careful study of the text. It was my privilege to look over the paper a number of times on the train en route to Chicago, and at each reading I more clearly received the import of the deeper meanings of the various phases of the subject treated. The paper is fundamental, and in undertaking a re-education in orthodontia Doctor Johnson's paper and subsequent papers should receive careful attention.

Doctor M. N. Federspiel.—In regard to Doctor Roger's splendid paper on muscular training, I must say it is an inspiration to us all to go back and try to do better work. Muscular training has been practiced in medicine for some time in curing kyphosis, round shoulders, and pigeon breasts, and the results obtained from so-called gymnastics, particularly the end results, have been wonderful.

The science of orthodontia is an organic part of medicine. It can not be separated, and we have to understand the various sciences which enter into the treatment of applied biology.

I can not add anything to what Doctor Rogers has said except to compliment him, and if he does as well from now on in studying the new classification adopted at the last meeting as he has in muscular activity, I will take my hat off to him.

Doctor C. A. Hawley.—I am very glad I was not expected to discuss Dr. Johnson's paper because it is one that I surely would not care to say anything about in the way of a technical discussion without reading it very carefully.

It seems to me, we have had three of the best presentations I have ever listened to before this society, and they have been in natural sequence.

I will say in regard to all of the papers they have been by gentlemen in whom from long association we have the greatest confidence, men who are conservative and essentially students of science, and to whom we can listen with the greatest confidence.

Doctor Rogers' paper opened a field that we have conceived was there, but we have not had the genius that he has had to develop it. We have talked for a long time about the primary causes of malocclusion, lack of function, and so on, and yet we have not really conceived the method of correction as it seems to me Doctor Rogers has done. Of course, in regard to just how far patients will go, and how much they can do, we who have not tried it are ignorant, but it offers the most hopeful prospect of anything to which I have listened. I heard a similar paper by Doctor Rogers some time in April, and talked over the matter with him personally, and I can relate to you what little experience I have had.

I went home and took two cases which probably are typical of those we often meet with in our practice, cases in which I had succeeded in obtaining practically normal adjustment and arch form, but in which the mesio-distal position relation was not normal. I used intermaxillary ligatures again and again but was unable to permanently restore the position of the jaws. I went home and sat down and talked to these patients and explained to them that I had done everything that I knew how to do, and said now the question was for them, and I tried to give them as nearly as I could these exercises. One boy I had worked on for a long time, and I got the occlusion established again and again, and yet while the position of the teeth would allow his biting forward in the proper position, in a short time the muscles would relax, and he would come in with the lower jaw hanging just as bad as ever. He was a boy of intelligence and understood the problem and went to work at it, and in two months time he himself made more improvement than I had ever been able to do before. I am greatly encouraged, and I believe from this experience I can thoroughly endorse Doctor Rogers' treatment.

Here is a phase of the subject that strikes me as very important: Patients are apt to come to us with the attitude, "I have malocclusion; I have this condition, and you are to do the work." Doctor Rogers places a different aspect on the question. He says I can do so much, but you have got your part to do. It is a co-operative procedure. I think that is a very important thing, and I never realized until I heard Doctor Rogers' paper the importance of it. It seems to me, that the extension of this work is going to do more to put orthodontia on the proper basis than any aspect of the work that has ever been presented.

In regard to Doctor Mershon's paper, the writer devotes the introduction of his paper to a discussion of the functional activities of teeth and associated organs during the progress of orthodontic operations. I heartily agree with his statements. In a broad way, it is generally agreed that malocclusion of the teeth is the result of lack of their use in childhood, especially in the period from the completion of the deciduous denture to the time when the first permanent molar is erupted and the deciduous teeth begin to be lost. The habits of mastication and the development of the muscles concerned with it are mainly formed during this period. How important then it becomes that these habits be not obstructed or lost by the interference of orthodontic appliances, and that the health of the surrounding tissues be maintained as well as the natural movement of the lips, tongue and cheeks. In this connection, contrast the simple appliance the author describes, with the old sixteen gauge labial arch having the usual number of bands and wire ligatures or

the later pin and tube appliance or even the ribbon arch with its necessary bands and brackets. The one leaves practically free the function of the individual teeth as well as the cheeks and lips, and others practically destroy them all. In the hygiene of the mouth the contrast is equally marked. As efficiency is the first requirement of an appliance it will naturally first be asked "Can the work be done with so simple an appliance?" The paper of the essayist is a competent answer.

As to the technical part of the paper, there are a few points that I might mention, not however of great importance. While in the majority of cases straightening the bends and kinks of the wire will produce sufficient length, if needed a small amount can be gained by making each bend at the compound bend in front of the molar pin, a right angle bend, then later making them obtuse. A small loop can also be made at a favorable place and later straightened, if thought necessary, or the wire may be cut and a piece taken out or put in. In any such manipulations, however, the greatest care must be taken not to disturb the relations of the pins to the tubes on the molar.

My own favorite size of wire is .035 or 19 gauge. However, some of my best results have been obtained with .030 and I have used some .028 with good results. Greater changes can be made at one time with the smaller wire, but at the same time the stability of the arch form is not so great, and it is more likely to be bent by the force of mastication. It is also not so favorable for the attachment of auxiliary springs.

I find heat treatment valuable in restoring the temper of the arch, especially after attaching auxiliary springs. The arch is heated to redness preferably in an enclosed receptacle, and then cooled slowly in the air.

The essayist has wisely cautioned against too much change at one sitting. As I look back at my first experiences I am satisfied that this was one of my prominent faults. A beginner will naturally ask, "How much change can be made in one sitting?" While this is very hard to answer, yet of one thing we can be sure, an arch should never be changed so much that it will not snap back to place and retain its position. It must be remembered that we are depending in the use of this appliance considerably on the force also exerted by the natural function of the teeth.

There should be great caution concerning the changes made in the pins attached to the molar teeth, especially in using the heavier arch. If care is taken in the impression and model, there should be no soreness after the first adjustment, but any subsequent adjustment that disturbs the relation of the pins with the tube, places strain on the molars.

In my experience it is not desirable to leave the arches without some fastening to other teeth than the molars. They may go along for months without accident, then by the use of sticky candy or lifting with the fingers to relieve some slight irritation, the arch may be bent and lifted from place. I first banded some convenient tooth and placed a short lug for the arch to rest under to avoid this accident, but later have made use of what I call a loop ligature. (Fig. A.)

The ligature may be of gold or the usual composition wire and unless rotation is necessary, answers every purpose in securing stability of the arch.

In some cases additional root movement may be desired in the incisor region. While this movement is not necessary so often, as in the use of labial appliances, owing to the free action of the lips, yet in many cases I have preferred to make this movement definitely in as short a time as possible. For this purpose I have used the old labial loop of light spring wire, .022 attached to the lingual wire just distal to the cuspids and coming through this opening which is present even in the most perfectly occluded denture. With the lingual arch resting closely against the teeth at the gingival border and the labial loop wire passing close to the incisal edge, root movement can be easily and quickly obtained. Considerable rotation can also be obtained with this wire. (Fig. B.)

I also use the Lourie arch. The essayist mentioned the fact that the lingual arch may be continued as a retainer and rightly considers it valuable for this purpose. It still, however, has the objectionable feature of the molar bands.

To obviate this danger I have been using for the past year a form of retention which developed from the McBride retainer, which I showed before the society about ten years ago at the Detroit meeting. This retainer consists of a skeleton plate of gold or vulcanite with wire anchored in the plate and passing to the labial side at the distal surface of the cuspids with clasps over the bicuspids. The wire as far as the forward portion of the loop, is made of 19 gauge clasp gold and the labial portion of ribbon arch wire. (Fig. C.) If the plate portion is made of gold, it should be cast as it must absolutely fit the lingual surface of the teeth. The principle is that a tooth to rotate must raise away

from the plate and the close fitting labial wire prevents this movement. If such a movement does start, slightly tighten the labial wire so that it will press harder on this tooth on the corner that is moving and it will quickly bring it back to place. After wearing the retaining plate continually for three or four months, I have found it sufficient if it is worn only at night. It will not, however, retain the rotation of small round-shaped lateral incisors nor lower bicuspids.

I have been working on this appliance for the last ten years, but have at last reached this form and I hope it will be successful. I am speaking of it at this time in view of its value in connection with these three papers. In the first place, there are no

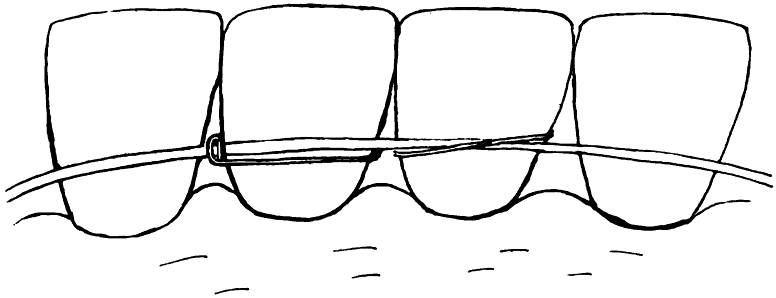

Fig. A.

Fig. B.

Fig. C.

bands upon the teeth. In the second place, after being worn a short time it can be removed during the day time and worn only at night. That makes cleansing of the teeth perfect and makes the use of muscle exercises much easier.

During the last six months I have placed something like over sixty of them in the mouth, and I have not yet had a serious failure, but I may have a big bunch of trouble next year. I do not know.

Considering the whole scheme of treatment, as outlined by the essayist, and which no doubt is susceptible of still greater development, it offers for our study and effort a treatment with which reasonable prophylaxis is possible and easy, a method in which the

teeth are reasonably free from the use of disfiguring and irritating bands and where the tooth brush and floss silk can be freely used and, most important perhaps of all, where the function of the lips and teeth are very little interfered with.

There was one point further I would like to mention, and that is, Doctor Mershon spoke of the time that elapses between the times of treatment. That becomes reasonable and easy because it is unnecessary to hurry treatment with this simple appliance. Many of these cases are treated without a single band on the anterior part of the mouth. Where the teeth are all tied up with bands and brackets, you want to hurry and get these things off as quickly as you can.

Doctor J. A. Burrill.—I have not had the opportunity to read any of these papers before they were read today, so I am not in a position to discuss them carefully. I am down to discuss the lingual arch, however, and I have this to say. Doctor Mershon's treatment is so much like some of my own, judging from his description that it is hard to add anything to it. If there is any place in which I can criticize his removable lingual arch it is the numerous springs. In my experience I have found that with a removable lingual arch, with two or three auxiliary finger springs as he calls them, there is too great a lack of stability and consequent irritation of the gum. It has been my observation that I can get along with less irritation of the gum by using bands instead of so many finger springs. However, I have had a good deal of success with the removable lingual arch in the way of general expansion, and after obtaining the general expansion to stabilize my lingual arch, I have added a labial bar which is parallel to the lingual arch, which lies in contact with the labial surfaces of incisors or incisors and cuspids as the case may require. This labial bar is attached to lingual arch by means of two short loops which lie in the

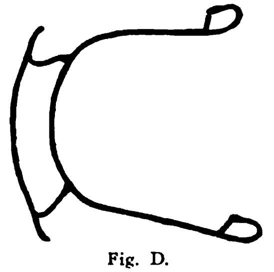

Fig. D.

incisal notch between the laterals and cuspids. These parallel bars are sufficient in some cases to rotate and retain incisors in torsal occlusion. (Fig. D.)

This appliance is also useful in depressing the incisors and lifting the anchor teeth in opening a long overbite. It is much more applicable however to the lower dental arch than to the upper. The drawing shows the manner of attachment of this labial bar as well as the manner of clasp I have used a great deal for attachment to the anchor bands. I have this to say, however, that I am gradually giving way to the soldered lingual arch and wire stretchers for such cases of expansion and I think I am getting better results.

Judging from the questions that were asked Doctor Mershon, I was led to feel that some of you were criticizing him for the length of time he took in accomplishing what he did in the particular case where it required one year. I feel that the extra time spent in carefully and slowly working these teeth into position shortens the necessary time for retention when that period comes, and as he said to us, the lingual arch is often all the retention that is necessary.

I feel that I can not help but refer in the matter of retention to the papers of Doctors Johnson and Rogers, and emphasize how necessary along with the active forces of occlusion are the normal muscular forces that have so much to do with the permanency of our results.

Doctor Milton T. Watson.—I have been much interested in all of these papers, and delighted to see that our problems are being approached from so many different angles. It is a hopeful sign.

I have a suggestion to offer in regard to the auxiliary springs Doctor Mershon spoke of. By using a wire drawn to two different gauges, it is possible to solder the heavier, or base end, without injuring the temper in the thinner portion; the result being a very

delicate, but extremely active, spring. These springs are made by taking a short piece of wire, which has already been drawn to the proper gauge for the base, or heavier, end of the spring, and putting it through the next smaller hole in the draw plate, but stopping while there is still approximately a quarter of an inch of wire of the heavier gauge. The wire, of course, has to be withdrawn from the draw plate backwards. Springs made in this way have proved much more satisfactory in my hands than where wire of the same gauge is used throughout the entire length of the spring. Retempering is, of course, unnecessary.

Doctor Ralph Waldron.—It has been my pleasure at the invitation of Doctor Mershon to go to Philadelphia and see him work, and the only comment I have to make upon Doctor Mershon's paper is, he has been too modest in his claims for this appliance.

I have experimented a great deal with the material used by Dr. Mershon, namely, platinum-gold alloy, and find it to be a most admirable material to work with, for it can be annealed and tempered as often as required without the loss of any of these properties.

If you will take a piece of No. 4 wire (Aderer) or E wire (Ney & Co.), and place it on a copper pan which is about 14 gauge (B & S) and heat the copper pan to a bright red heat, then plunge the wire into cold water. This will anneal the wire so it will become soft enough to tie in a knot without breaking. Now if you will put this wire on the copper pan again and heat it as before until it becomes a bright red color, then allow the pan and its contents to cool in the air, all the original spring temper this wire possessed will be restored.

Some member has asked how it is possible to get the spring effect in the finger which has been soldered to the base wire.

The base wire is 19 gauge or about .037 of an inch in thickness. The finger spring is only .022 of an inch in thickness and after soldering with 18 or 20 karat solder, and upon cooling in the air becomes springy again. Now bending the finger spring to the desired shape adds a little more spring quality to the finger, this is sufficient for all the force needed to move individual teeth.

Doctor Robinson.—Does this restore the temper given to it by the draw plate after it has been heated?

Doctor Waldron.—You can restore the original temper exactly the same as when it left the manufacturer, because the manufacturer anneals and tempers this wire after it leaves the draw plate, and before it is sold to us for our use.

Doctor Robinson.—I would like to get the formula of the wire.

Doctor Waldron.—I do not know the exact formula, but the No. 4 wire is far superior to the other wire manufactured by Mr. Aderer, and he informed me that the No. 4 contains; Au, 84 parts, Pt, 23 and 8-10 parts, and Cu and Ag, 35 parts.

Doctor Robinson.—I have never seen a wire that could be heated in any way to give any such temper as it has when it comes from the draw plate.

Doctor Waldron.—I would like to ask Doctor Mershon if he has not found that he can get all the spring he wants in the finger wire by allowing it to cool down in the air after soldering.

Doctor Mershon.—By allowing it to cool down and bending the wire you may not get the same temper you had in it originally, but I can say in all cases it is sufficient.

Doctor R. Ottolengui.—I did not really intend to contribute to this discussion, but I am tempted to say something in reply to Doctor Hawley. Doctor Hawley in speaking of his retaining plates, said they must be cast, because they must fit accurately to the lingual surfaces of the teeth.

I have had a very considerable and very unpleasant experience with cast gold plates. Plates that are cast are necessarily heavily alloyed with low grade metal. That may be one of the reasons for the trouble that I have observed. Another possible reason is that in casting these plates the surface comes out granular, and in our desire to get an actual fit to the surface which comes in contact with the gum, the plate is not really polished. The granules are not removed. Whether it is a chemical disturbance or a traumatic disturbance due to the granular surface I do not know; but you can not put one of these plates in an adult mouth and leave it a year without having a chronic inflammation of the mucous membrane. That can all be done away with, and Doctor Hawley's wishes can be fully met, so far as perfection of fit is concerned, by making accurate models, and accurate dies. Then swage a plate of 36 gauge pure gold; then with

another set of dies swage another plate of 20 carat gold, and then sweat two pieces together. You have a smooth, polished gold surface against the rough mouth; you have a fit; you do not have the inflammation you get from the other styles of plate, and the plate is just as rigid as if made by the casting process.

Doctor Frederick C. Kemple.—The presentation of these three papers this afternoon offers a very interesting study in the evolution of the practice of orthodontia. It seems that we are getting to fundamental principles; we are getting away from complicated methods. We are getting away from the idea that we can take the mouth of a patient and mould it into any form we choose in spite of physiology or function or anything else.

The paper presented by Doctor Johnson is one that ought to be read and re-read and studied before it can be fully understood and appreciated by most of us who are practicing orthodontia. It gives an exceedingly broad view of the fundamentals of orthodontia.

I agree entirely with Doctor Rogers in regard to the efficacy of muscular development. There is no question that if these muscles are toned up they will aid materially in restoring natural function. The difficulty as I see it lies in securing the cooperation of the patient to the degree sufficient to develop the muscles of mastication to the normal tone. And with the presentation of the lingual arch and the little finger springs allowing individual tooth movement. I think it is a most hopeful sign. The very extreme enthusiasm that greeted the introduction of the pin and tube appliance seemed to me a backward step in orthodontia. It seemed to be getting away from natural function.

The presentation of these papers this afternoon may mark another era in orthodontia. I know that some of these essayists were very enthusiastic users of the pin and tube appliance, and now they are getting back to the point of preaching and teaching freedom of individual tooth movement in all of this work. It is very gratifying indeed.

Doctor V. H. E. Jackson.—I am interested in seeing how we are working towards the finish, and I am glad to see we are getting through different forms of springs, and it is nice for people who have made them to see what results you get, and I hope you will keep it up until you master it. There is no doubt about the value of these springs. I am very enthusiastic over the spring force; I have had a good deal of experience with the lingual spring and the labial spring. I prefer the lingual spring for the general expansion of the arch when it can be used to advantage, and I see you are using it to advantage.

I am very much pleased at the exposition we have had here today, and I shall be interested still more in seeing how we work tomorrow. I am gratified to see what the boys are doing and anything I can do to help the spring will be gladly done.

Doctor A. Leroy Johnson.—(closing on his part): I have nothing to add to the discussion, but I would like to take this opportunity to thank you for the privilege of attending this meeting of the American Society of Orthodontists. I am enjoying it immensely.

Doctor Alfred P. Rogers.—(closing on his part): It is pleasing to me that the arrangement which the Board of Censors was kind enough to make in having Doctor Johnson's, Doctor Mershon's and my paper read in succession has worked out so nicely. I think it was Doctor Johnson's suggestion that they be arranged in this order. I, therefore, think that the Society should give credit to Doctor Johnson.

Doctor John V. Mershon.—I have nothing to say in closing the discussion on my paper, except that I regret Doctor Burrill did not receive a copy of it to read before he began his discussion. It was mailed to him, and it was returned to me in Philadelphia, and I received a wire to this effect up in Maine where I was spending the summer, that a copy of my paper was returned to my office.

Doctor Burrill spoke of the great number of springs I am using. It would appear that I use auxiliary springs almost exclusively, which is not the case. I showed a great number today to demonstrate the various movements which can be produced by the use of those springs.

TEACHING OF ORTHODONTIA TO UNDERGRADUATES*

By Ralph Waldron, D.D.S., Newark, N. J.
Professor of Orthodontia, New York College of Dentistry.

THE beginning of orthodontia, like many other sciences dates back into the obscure past, and was subsequently practiced by those who were totally ignorant of the physiologic functions of the teeth.

They knew teeth moved and changed their respective positions, but they never considered such things as the etiologic factors which caused deviation from the normal, like Topsy, "They knew they just grew that way," and we are not surprised when we find as late as 1897 one of the leading textbooks on this subject contains but four pages on etiology.†

The principal thing that attracted the attention of the dentist, was the ugliness of the case at hand, and in his endeavor to better the appearance of the patient he extracted teeth or made some mechanical device which naturally was very crude and usually clumsy, and I am very sorry to have to admit this condition exists to a limited degree to this day.

The making of orthodontic appliances used to be considered as mechanical dentistry, and was taught by the professor of prosthetic dentistry, who lectured upon this subject, not because he was unusually skilled in the science of orthodontics through practice, but because he could not pass it over to some other member of the faculty.

Luckily, for all concerned, orthodontia became a distinct science, founded upon definite principles, with a diagnosis, and a well-defined line of treatment, with a rational prognosis, through the energies and studious thought of men like Doctor E. H. Angle, and many others who need no introduction to this society.

These men labored long and hard, that orthodontics should not only survive but should be classed as a true science founded upon biological principles and not merely a mechanical art.

Within the last few years our universities have become thoroughly convinced that orthodontia is a distinct and separate branch of dentistry, and have created a chair of orthodontics with a professor who devotes his time exclusively to the practice of orthodontia, and who has a separate staff of instructors in this science whose duty it is to instruct the students and supervise their ever increasing clinics.

No man can sincerely dispute the fact that the study of orthodontics is a postgraduate work if it is to be brought to the ideal, but this is not always possible, for the general practitioner of dentistry must undertake many of the cases which develop in his practice, especially if his practice is in a district far remote from a locality which can support an orthodontic specialist.

*Read before the Eighteenth Annual Meeting of the American Society of Orthodontists, Chicago, Ill., August 1-3, 1918.

†Kirk's Operative Dentistry (1897 edition).

The department of education in our various states, realizes this and some have laid down a minimum course of study for all dental schools, seeking to be registered by the state board of dental examiners within their respective states, and naturally the colleges wishing to be credited in the various states live up to these minimum requirements and some greatly exceed them.

The Board of Regents of the state of New York have set the following as the minimum of orthodontic requirements they will accept from colleges seeking recognition, in order that their students may take the licensing examinations of the state of New York and be entitled to practice dentistry within that state.

The following is the minimum course accepted by the Board of Regents of the state of New York:

FOR THE THIRD YEAR

Fifteen hours of recitation and lectures on orthodontics.

Fifteen hours of laboratory work on orthodontics. Seven and one-half hours credited time.

Actual time, thirty hours.

Credited time, twenty-two and one-half hours.

FOR THE FOURTH YEAR

Fifteen hours lecture and recitation on orthodontics.

Sixty hours laboratory work.

Actual time, seventy-five hours.

Credited time, forty-five hours.

The lectures to be upon the following topics for three or four years: Historical sketch; consideration of former methods; technic of wire drawing, soldering, etc.; nomenclature and definitions; normal occlusion; forces governing normal occlusion; transition from deciduous to permanent denture; malocclusion; forces governing malocclusion; classification of malocclusion (Angle); etiology; benefits in correction of malocclusion; importance of the first permanent molar as a key to occlusion; the sizes, forms, interdigitating surfaces, and position of teeth in the arches; the line of occlusion; facial harmony and balance; process and membrane, including tissue changes incident to tooth movement; dentofacial orthopedia; consideration of instruments; anchorage and dynamics; adjustment of appliances; impression and casts; treatment of Class I; treatment of Class II; treatment of Class III; principles of retention by classes; care of the mouth and office records and management of cases.

We have now arrived at an era of dental teaching when the various branches, distinct though they may be, must be so correlated and interwoven in their presentation to the student, as to make the entire subject a complete presentation.

The interdependence of the various subjects must be more and more forcefully placed before him. For example, the technic of wire drawing, annealing and tempering of orthodontic metals and alloys are taught by the professor of chemistry and metallurgy; anatomy of the mouth and teeth are not taught by the professor of orthodontia alone, but also in the departments of anatomy,

dental anatomy and operative dentistry, two years before he studies orthodontia.

The alveolar process and peridental membrane can be better taught in the department of histology, while diseases of the mouth are taught by the professor of that subject and touched upon by almost every member of the faculty, whenever it bears upon his work. The technic of soldering is taught in the prosthetic dental department and the student does this continually more or less the first and second year of his college course, so when the student has reached the third and fourth year his mind has been so trained and he has become so skilled in technic that he is in a receptive condition to absorb orthodontia and the correlated dental subjects. In other words, the so-called nondental subjects, as anatomy, physiology, metallurgy, chemistry, bacteriology, histology, pathology and physics, also prosthetic and operative technic should have been completed before he is allowed to continue into the third and fourth year and by this method the student will be better fitted to learn and practice orthodontia and dentistry.

The plan which has been approved of by the faculty of the New York College of Dentistry for the course of orthodontia is as follows:

Thirty hours of lectures in the third year.

Thirty-six hours of laboratory work, which is more than twice the amount demanded by the Regents.

The laboratory work is as follows:

1. Impression-taking and model-making of orthodontic study models.

2. The construction and application of two Angle expansion arches, using Mershon's method of band construction and adaptation, and cementing same to models.

3. Construction of Mershon lingual removable arch, on upper and lower.

4. Construction of Ainsworth arch with bands on molars and bicuspids.

5. Construction of Angle pin and tube appliance, with Young-Angle latch lock on upper.

6. Lingual arch on the lower with fingers as is advocated by Dr. Lourie.

The lecture course for the third year consists of thirty lectures, one hour each week, for a period of thirty weeks, upon the following topics:

1. Preliminary outline of the subject of orthodontia.
2. The literature of orthodontia.
3. First principles. (Scope.)
4. History.
5. Nomenclature.
6. Development of dental arches.
7. Normal occlusion and the forces which govern the same.
8. Distinction between occlusion and articulation.
9. The transition from the deciduous to the permanent denture.
10. Malocclusion of teeth.
11. Malrelation of arches.
12. Classification according to Angle and Lischer terminology.
13. The attachment of the teeth.

14. Tissue changes caused by mechanical stimulus, or tooth movement.
15. Harmony and face form.
16. General outline of anomalies.
17. Etiology.
18. The alveolus and peridental membrane, from an orthodontic viewpoint.
19. Impression, models and plaster technic.
20. Duplicating orthodontic models.
21. Photographs and records; their value and uses.
22. Uses of x-ray in orthodontia.
23. Soldering and band technic.

FOURTH OR SENIOR YEAR

Fifty-four hours of practical work in the clinic upon patients.

Three hours (nine to twelve), one day each week, for a period of eighteen weeks.

This is absolutely imperative and no man will be graduated who fails to live up to these requirements.

The lecture course for the fourth year is as follows:

1. Preparation of the mouth for orthodontic treatment.
2. Records of treatment.
3. Diagnosis.
4. Arch predetermination. Hawley, Stanton, Hanau and Sved.
5. Dento-facial deformities.
6. Prognosis of oral deformities.
7. Anchorage.
8. The evolution in methods of treatment.
9. Dynamics.
10. Application and construction of fixed appliances, of all types, for orthodontic purposes.
11. Treatment of malposition.
12. Treatment of simple neutroclusion } Class I. Angle.
13. Treatment of complex neutroclusion } Class I. Angle.
14. Treatment of simple distoclusion } Class II. Angle.
15. Treatment of complex distoclusion } Class II. Angle.
16. Treatment of mesioclusion Class III. Angle.
17. Treatment of unilateral mesio-distoclusion Class IV. Pullen.
18. The surgical treatment of extreme jaw malformations.
19. Retention of all kinds.
20. The problem of extraction or the "compromise treatment."
21. Jackson and other removable appliances.
22. Care of the mouth during orthodontic treatment.

This course was not formulated to educate specialists, but to give the undergraduate the necessary ground work for his after-study and development, for no college can expect to turn out a finished product. It is time and experience, which are the parents of such a child, but the graduate dentist must know

enough about orthodontia to recognize malocclusion in its incipiency and be able to properly advise parents what course they should pursue, and save the child the necessity of prolonged treatment by early and skillful diagnosis.

DISCUSSION

Dr. F. M. Casto.—The subject of this paper I think is most opportune. At the present time, there is a great revolution taking place in dental and medical education. You probably all know that there has been established in the Surgeon General's office of the War Department a dental and medical educational department. It is the purpose of this department to standardize dental and medical education. They have the opportunity to do this because they have practically direct control of these institutions. It probably would not be possible to bring about the tremendous changes in the curricula and in the requirements of these educational institutions; it would not be possible under any other conditions than those that are existing today. You probably all know that these institutions are kept alive by virtue of the government permitting men to enlist in the Enlisted Reserve Corps of the Medical Department, and then they are placed on a negative status until their courses are completed. They have direct control not only over the requirements of the educational institutions, but over the requirements of the individual student in these institutions. The man who is not promoted with his class, and does not meet the requirements, will not be allowed to remain in school. He will be taken immediately, when he fails of promotion into active service in the army as a private. They are now working in cooperation with the Dental Educational Council of America (that is, the War Department) and have established a classification of schools. They have placed dental and medical schools in Classes A, B and C. Class A schools meet certain requirements; Class B schools may be able to meet the first requirements, and Class C schools are schools that can not meet the requirements of Class A or Class B schools without reorganization. They do not recognize Class C schools. Therefore, all students in Class C schools in the draft age will not be allowed to remain. Any man in a Class C school is subject to draft and will be called; therefore, a Class C school can not remain in business except for those who are not eligible for the army. You can readily see what that means. Those of you who are familiar with the evolution of dental and medical education probably know the great difficulties and great problems which have been experienced in bringing about higher requirements. It has been a very difficult task.

In regard to the branch of orthodontia, there is a requirement in the Class A school for teaching a certain amount of orthodontia. You will all agree I think that the proper teaching of orthodontia is fundamental to the welfare of the future dentist, and especially to the welfare of the future progress of orthodontia, because the men who are to succeed the present quota in orthodontia are those who are naturally going through the dental schools.

Another reason why it should be properly taught is that with practically all state boards throughout the country orthodontia is made a requirement just the same as is any other of the branches. I might say for your information in regard to the requirements in a Class A school the number of hours that are required now are approximately 4500 hours of teaching to the students in the four year course. That means about an average of 1100 hours a year. Probably some of the older members of the society, including myself, had a third of that number of hours.

In regard to the work which Dr. Waldron has outlined and scheduled in his school, I wish to commend it. I concur in what he has said and the manner in which he is teaching. The work I have been doing personally has not been up to the present time conformable to all the work that he has laid out. It has been impossible to do that, but I expect next year, and as soon as we are on a complete four year course, to install practically the same amount of teaching that he is giving. You all realize that in a college giving a three to four year course it complicates things considerably. For instance, this coming year we will have in our school no junior class. Next year we will have no senior class. There is a great clinical proposition to take care of, and the teaching of these men in the sophomore class now and sophomore class to follow will be different when the complete four year schedule is installed.

One of the greatest difficulties I have found in the real teaching of orthodontia is the clinical proposition. You all realize that in a dental school it is naturally difficult. The reasons are obvious, but we have attempted and will attempt further next year to have

a certain number of practical cases that may be handled partially at least by the students themselves. We have installed for the coming year a man who will take charge of the orthodontic and the periodontic department, and we feel we shall be able to get better results than we have heretofore. The students are quite enthusiastic about orthodontia until they get cases, then they lose their interest.

Doctor John V. Mershon.—I am very sorry that I am to discuss Doctor Waldron's paper. It is very difficult to talk on a subject about which one knows so little. I have occupied a teaching position for the last two years, before then I thought I knew more about teaching than I do today.

The teachers of orthodontia in the undergraduate schools are between two fires. On one hand you have as the essayist has outlined, a fixed requirement which is laid down by various states. On the other hand, you have another condition, the state boards, which are asking questions ranging all the way from jackscrews to still voting for Andrew Jackson. After you have employed enough time to meet all these requirements you can then start to do the teaching. I do not blame state boards, in fact I have the greatest of sympathy for them; they have a very difficult task. For if in a meeting such as we are having at this session, discussing various subjects as we have, with the differences of opinion we hear from the men who are specializing in this department, differing quite radically from each other, how can we expect men on state boards to keep up with it?

How can you lay down fixed rules for a progressive science in which our ideas of next year are different from what they are today?

As for the clinical side of the course in the undergraduate schools, I question very much its value as a teaching method. We should but consider that the treatment of a case of malocclusion covers anywhere from four to six years, sometimes the life of a patient, you might say. Students will have patients probably through one session, or part of two sessions, seeing the patient a little while in the winter season up until May, when they have to discontinue their cases because they are studying for examinations. These cases are left until the following October or November without any attention, unless the school is carried over in the summer and has a corps of assistants to carry these cases over the summer, and this does not teach the student. In some of the large schools such as Doctor Waldron takes care of in New York City, where they have enormous clinics, this is a difficult problem, to say nothing of the injustice to the children coming to these clinics under these conditions.

How can we as teachers in a school where the men have to absorb operative dentistry, root canal work, and everything else pertaining to the whole curriculum in the dental schools expect the students to become proficient in the practice of orthodontia with their limited opportunity?

Practice can only be acquired through long experience, and I think it is a waste of time to undertake to teach the practice of orthodontia in an undergraduate school. I think the most of our time and energy should be devoted to the teaching of principles of, and etiology of, malocclusion and the possibilities of failure, and it should be taught as a department of biology and pathology.

Dr. B. E. Lischer.—In addition to a feeling of reserve on educational matters, I have had no opportunity to read the paper, and hence can only express myself very briefly on the subject of dental education. I note that Dr. Waldron limits the title of his paper to "The Teaching of Orthodontia to Undergraduates," for which I am deeply grateful.

This entire discussion, it seems to me, might be very logically divided into the immediate and ultimate. By immediate, I mean the present provisions in orthodontic education, and by ultimate, its final status.

It is an established fact, and it is becoming very widely known, that oral deformities are of very common occurrence. Fully fifty per cent of the children of every community are undoubtedly affected by them. The number of individuals that a practitioner of dentistry, or a specialist for that matter, can adequately serve is very limited; so much so, that no community at present is receiving the necessary orthodontic service. It is one of the duties of the profession to assist in providing this service in as efficient a manner as the circumstances will permit. Unfortunately, though society itself must provide, in part at least, the circumstances which make for thoroughness, it has not done so up to the present time. That undergraduates should receive instruction in the principles and methods of orthodontics permits of no arguments. Whether the time usually allotted to the subject permits of anything more than a mere superficial acquaintance with its contents is open to debate. I am yearly becoming more thoroughly convinced that the entire

dental educational system of today is inconsistent. Dentistry, including orthodontics, is a department of medicine and surgery. The advances of science have demonstrated this finally. The dental curriculum must therefore be recast to be in harmony with the best science of today. In other words, stomatology should be taught thoroughly in every medical institution. To do this, it will probably be necessary to reform the entire medical curriculum also. This must be the ultimate goal of all our efforts in educational matters. Any change of plan that does not keep in view the supreme end is a temporary compromise. Most dental educational reforms have thus far ignored this fact.

Dr. M. N. Federspiel.—I have come to believe that the entire teaching curriculum in dentistry is wrong, and I believe it would be a good thing if we closed the doors of every dental school in the United States and asked the dental profession to rap at the doors of the medical profession and ask for admittance. Think of it. Today in our profession we are trying to teach a smattering of medicine, and we still try to be allied to or associated with medicine.

I believe the time will come when we shall do less dentistry but better dentistry. The average crowns, ill-fitting crowns, and average bridges put in the mouths of patients today harbor pathogenic germs and are contributary factors in producing more diseases for doctors to treat. We are operating paths that are feeders of the medical profession. That seems to be a strong statement.

I do not think it is fair to let any dental student treat any orthodontic case at any time while he is a student of the school. I could not consistently ask a dental student in my oral surgery work to do a cleft palate operation, to do a resection of the jaw, or to remove carcinomatous tissue. He is trained to know that medicine is nothing more than applied biology. He is trained to know that he must be able to make a diagnosis and a differential diagnosis. He is trained to know what biology is and what it means, and he is trained to know that treatment completes diagnosis and prognosis. Treatment is not complete until he knows something about diagnosis and prognosis.

After this great war is over, the average man who entered the Dental Reserve Corps will be an oral surgeon. That is a natural sequence. Everybody is going to be an oral surgeon. All he has to do is to take a knife in hand, draw a little blood, and he is an oral surgeon. (Laughter.) He buys a few curettes, wears a white gown, may have his operating room carpeted, and pretty shades on his windows; he may look the part of a doctor, he may make an incision in the gum, curette, scrape, and poke around with gauze; but when you ask him to note the tissue changes that have taken place and what takes place in the healing of wounds, he is lost. He can not tell the abnormal from the normal tissue when he uses the knife. He has not been trained in etiology; he has not been trained in histopathology.

The time is coming when we are going to have more group diagnoses; the one-man diagnosis will pass out of existence. You can not go to work and become so proficient and finally practice orthodontia as a specialist without getting the aid of others in certain cases. We must have group diagnosis, and that is the ultimate goal of the art of medicine. So I believe that orthodontia can not be practiced as successfully unless you have the cooperation of men around you. When, as Doctor Mershon says, a patient has to be treated for six or ten years, there must be something wrong. I do not like this perpetual treatment of patients. In my estimation, the ultimate goal of the science of dentistry will be a part of medicine; that every man must have the same entrance requirements that the physician has, namely, a bachelor of science degree. Dentistry will then become a specialty of medicine the same as ophthalmology, rhinology, surgery, or genitourinary diseases and so on.

Dr. William C. Fisher.—My remarks before this society are not to be considered purely from the standpoint of a student, yet I am still a student. I am not a teacher of orthodontia, but as a student of orthodontia I have naturally followed the teaching of orthodontia, and I think there are one or two points that have not been touched in any discussion, not only here today but in the past nine or ten years in this society.

As a guest of the society, I am going to try to tell you one of your shortcomings. I do not think you men have measured up to your responsibility in the teaching of orthodontia. When I took up orthodontia ten years ago I could not find what I considered (and that is no reflection on the Angle or the Dewey course) a high grade postgraduate course in orthodontia in America, and in desperation I turned to you gentlemen and your annual meetings, and it has been my postgraduate course, and I hope to make it a never ending one. But it does seem to me in the ten years I have been so cordially associated

with you that this society should have established, not a committee on nomenclature, although you established a good one, and this was done only recently, not a committee to consider this or that educational subject, but a council on education along orthodontic lines. You have the men in your society; they have the brains. There are no men on the Council of Dental Education of the National Dental Association that are your superiors, and few of them your equals. There are none in the Council on Education of the American Medical Association that are your superiors. They have done it. When you consider that the American Medical Association has continued a man like Arthur Dean Bevan, of Chicago, as the head of their educational council year after year until he was made president of the association, you must realize that they have got somewhere. They have standardized teaching. It seems to me, a body of men like you could organize a council and, if necessary, work in conjunction with the Council of the National Dental Association. They would welcome your assistance in this specialty. If such a council was formed and the results of their work made known, I am sure the boards of education and the state dental boards of the various states would gladly welcome your suggestions and criticisms.

I have wondered if a copy of the nomenclature you adopted last year has been sent to all of the members of the dental educational councils of the forty-eight states. Has it? I mean state boards of dental examiners.

Dr. Casto.—It has been published.

Dr. Fisher.—You have a wonderful work, and you men not only will measure up to it, but out of that will accrue what you absolutely need in this country, namely, not one postgraduate school but postgraduate schools that are standardized and receive the approval of this body of men. I thank you.

Dr. Allen H. Suggett.—There is another phase to this question we have to consider in enlarging our curriculum and making it more intensive and extensive, and it goes along the line of what we were talking about last night in democratizing dentistry. We want better education, longer and better training. We are all more or less handicapped by the conditions under which we are working now in the different universities. The academic courses are all free to students who go there. There is no tuition fee exacted except in the medical and dental departments. In mining enginering, in all other professions and arts, in the universities tuition is free to the student, but not in the dental and medical departments. In those departments large fees are exacted. I say large fees, they are large fees for the average dental student for a three or four years' course as it is now, and most of them require a junior certificate before they can enter there. There are six years of college work. We are going as fast as we can in that direction when we consider how far the state has gone in tax-supported help to the student. If we raise the standard so high and make the curriculum so long that it is going to work a hardship to those who have not the financial means, then we should cut down these courses because we are working against the democracy we have been talking about and putting into the conditions today. We will have to work up the other end of the line and better our education of the people under tax support. No matter how poor the boy is, he should be given an opportunity to go ahead. He should be given the privilege to go through the high school, enter the university, and receive six or eight years of training, as a rule, in the course of time. The more help we can render along that line, the more opportunity will present itself for each man to take up the thing he can do best.

Why is it we have so many failures in life? Do I have to be a shoemaker because my father was one before me? If he were a dentist, there is a chance for me to fall into that for financial reasons. Whether I am a chemist or something else, it is financially impossible for me to choose. Then we can enlarge and lengthen the courses so that there is a chance today to do good for the masses at large rather than to put these things into the hands of a favorite few.

Dr. Federspiel spoke of the Marquette University reducing the number of students from three hundred to forty. That is a good thing in one way, but it is a sad reflection on the state in another way. There are many of those men perhaps the ablest of them, who were financially unable to take this course and had to drop out, but others on account of financial reasons kept on. We should strive to do as much good as we possibly can for the masses at large. While you may have high grade students today, that does not mean you have not cut out superior men on account of financial reasons. While we are getting education and a better course of training, which I believe we all advocate and endorse, let us not lose the social point of view.

Dr. G. W. Grieve.—I was one of those who requested a paper along these lines, because I have been up against the problem of trying to teach orthodontia in a dental school. I have felt for a long time that this society should do something along the lines clearly outlined by Doctor Waldron, or there should be appointed a committee which would eventually produce something we could work upon. It is the dream of all of us, and we shall have to come to it gradually, step by step, and be entirely familiar with it. It is coming, and we should do all we can to advance the science of orthodontia, so that the next generation may have the privilege of living in a period when many of these things we do not enjoy now will be possible.

At the present time, with the facilities we have, and the length of the course in the dental schools, we should strive to establish some kind of maximum course in orthodontia for men taking the general course, the standard of which would be much below that practiced by the men who are specializing. I think this should be undertaken by means of a council as that suggested by Doctor Fisher, establish a course which should be adequately taught and could be more or less absorbed by the students in dentistry.

If I understand the paper of the essayist correctly, he outlined a course which takes into consideration the technic of the work of making appliances on models, even using Doctor Angle's pin and tube appliance, the removable lingual and labial arches of Doctor Lourie with the finger springs, and all the appliances which we are now using as specialists. I think it is a mistake to attempt to teach such things, for those of us who have taught in dental schools know it is a hopeless task. The men going out into general practice, lots of them into country districts, can not refer their cases to specialists, and these men ought to have some knowledge of the subject. There is an old saying, "A little knowledge is a dangerous thing." If we can so formulate a course and dictate to the dental boards and the faculties of dental colleges how far the course should extend, I think then we shall be working along the right lines with the faculties which we have at present for teaching orthodontia in dental schools. You all know it is impossible in a dental school for students to gain a knowledge that men can possess after a number of years in practice as specialists, so to expect them to use Doctor Angle's tube and pin appliances and correct difficult cases is out of the question. If we can formulate an idea of how much these men might be able to absorb, and how much we might teach them, the knowledge of which would be useful, but not dangerous, it would be a splendid thing. The great difficulty I find is to be able to know where to draw the line. It may be possible to draw the line where those men in general practice may be able to treat patients with of underdevelopment and thereby prevent lots of the more difficult and intricate cases of malocclusion. It seems to me we want to work along these lines, and I agree with Doctor Fisher that this society and its members have not done their duty in this matter. Many of the members of state boards and faculties of dental colleges have not the knowledge of men of many years of experience in orthodontia, and yet they are expecting us to do things in the teaching of orthodontia in dental schools which are absolutely impossible. Why not tell them it is impossible, and that it can not be done?

I think you will all agree with me in regard to teaching orthodontia in a dental school, in this respect, that with the limited amount of time the students have and the multiplicity of duties covering the whole practice of dentistry, it is absolutely impossible to accomplish very much. Let us try to make up our minds how much they really can absorb, and then formulate a course as nearly as possible which will conform to that possibility, and in that way get a start. We can not start at the top as Doctor Suggett has suggested, but we can work towards that end. Let us try and get where we can teach them something, but not attempt what is absolutely impossible for them to absorb.

Another great difficulty is the fact that we can not recommend an existing textbook on orthodontia in a dental school. There is no one book that covers the requirements; they all give the student too much. A textbook might be formulated covering the courses especially adapted to those men. Students in dentistry might be shown slides of cases that have been treated by the skilled orthodontist, but they should not be led to believe in the possibility of their treating those difficult cases unless they discontinue the general practice altogether and fit themselves as specialists in orthodontia.

Dr. U. B. Shantz.—I have never been a teacher in a dental college, nor a specialist in orthodontia, although the subject has appealed to me as being of much interest. I have gone through one or two colleges, and I am at this time confronted with the idea that sometime in the future I shall contribute a student to one of the dental colleges, provided my only child shows any degree of fitness for it, and the question arises, since

I have got rid of focal infection and rheumatism, and other things, will it be general practice or will it be a specialty, root canal treatment, the specialty of orthodontia, or what will it be? And the question has arisen in my mind, if it shall be orthodontia that my child shall take up, why should she spend the bulk of her college time on crown and bridge work, on operative dentistry or plate work?

I have been in Doctor Grieve's office, who has spoken. He has not enough equipment in his office to make a plate, because he is doing orthodontic work exclusively. The last time I was in his office I saw a young man who graduated this year in dentistry. He has learned to put in gold fillings, but I am told he has not been able to learn orthodontia in a short length of time. Now, would it not be better to have a selected course for such a man and get him into a place where he can do orthodontic work early in the course even if it would compel him to stay in the city for twelve months in the year. Most of these chaps would rather live in the city than in the country and spend three years on a course if they are going to practice orthodontia, and give them as little general dentistry as they need to know orthodontia. In other words, to parallel if possible the thing that happened sixty or seventy-five years ago perhaps when the dental profession was founded out of a part of the medical profession, and at this time the profession of orthodontia should have a separate college or separate course, gaining only sufficient knowledge of general dentistry as the practitioner may need, the same as we today are gaining only sufficient knowledge of general medicine as we may need, not as much as we would like to have, but as much as we absolutely have to have. This question appeals to me, and I wonder whether that will be a solution or not. I do not know. I wish I did.

If the idea I have advanced will furnish food for thought to some of you who may be on the council to be organized, I am glad that I have contributed it because it is a phase of the subject that was not mentioned in the discussion.

Dr. F. M. Casto.—There was one matter mentioned which I think is of very great importance, and it has been suggested that we might have closer association between the American Educational Council and the council from this association or any other association of dental colleges and state boards. The dental colleges, as I said a few moments ago, are under the supervision of the War Department at the present time, therefore the requirements have to be lived up to. Standards are being established all over the country so that a dental student admitted in New York or California, or in the North or in the South will have practically the same education. No standardization has ever been made of state boards. The standardization of state boards is the standard of each state or the standard of each board. The government at the present time has no supervision over the state board of dental examiners, so that there is no coordination between dental teaching and state board examinations in many of the states. There is no coordination between the teaching in dental colleges and state board examinations in many states, and if anything can be done to bring about closer cooperation between these organizations it would only be fair to the man who is to put in his time studying dentistry.

Dr. Burt Abell.—Why would it not be a good idea for this board of control of the government to send out the examinations, in order that that may be taken out of the hands of the state boards?

Dr. Casto.—It can not be done now on account of the state laws.

Dr. Fisher.—This regulation that Doctor Casto refers to will end with the war. The only thing we can hope for in this respect is to form some character of organization, such as a national organization of your dental examining boards just as some of the colleges have throughout the country. I mean a real one, and I do not mean the way it has been run.

Dr. Casto.—We have to have standardization throughout the country so that there will be coordination between the two.

Dr. Allen H. Suggett.—A state board of examiners is superfluous. I believe it is only a matter of time when the government will control the different colleges, so that when a man graduates from any college he can practice in any state. At the present time, some of the states have a higher standard than others, hence it is more difficult to pass the state board in some states than it is in others, but I believe in the course of time this will be eliminated or rectified.

Dr. Waldron.—I am pleased that my paper has brought out such a free discussion, for that is why the paper was written, in order that we may standardize the teaching of orthodontia in our colleges, but I am sorry no suggestions have been offered wherein some beneficial changes may be made.

It has been pointed out by Doctor Mershon that we have to prepare students for the state board examination, as well as to give them a dental education, and he has truly remarked that many of the questions asked by members of these boards are very ancient. Therefore we must instruct students in these antiquities in order that they may give satisfactory answers to men whose ambition it is to be members of these boards, regardless of their qualifications.

Luckily for all concerned these men are in the small minority, and I hope the day is not far distant when there will be a standardization of state boards as well as dental colleges.

I think that Doctor Grieve has not understood that part of my paper regarding the technic work in the junior year. We have devised a manikin head at the New York College of Dentistry and the student is obliged to construct the technic work upon models in the manikin head, which I think is about the nearest thing to working on the living subject.

This is merely the construction of appliances and their application on technic models, in order to prepare the student, that he may be more able to work on the human being in his senior year.

It would be a mistake to give a student material and allow him to work upon a patient before he has had practice upon some inanimate object.

The idea of this technic work is not to impress upon the student that we recommend these kinds of appliances, but that he may have a variety of technic work, in order to better fit him for the construction of such appliances that are to be used on living subjects in the senior year and later in his own practice.

DENTAL ENGINEERING: WE ASSUME—WE CONCLUDE

By Rudolph L. Hanau, Pittsburgh, Pa.
Consulting Dental Engineer

We take it for granted that the author of "Determining the Shape of the Normal Arch" (*Dental Cosmos,* July, 1917) is perfectly honest in his intent, yet we are constrained to observe that a comprehensive knowledge of dental engineering would have led him through a different lane of investigation,—one that does not lead to misconception of the problem and to vague conclusions.

A thorough understanding of dental engineering would have rendered the investigator self-supporting and could have precluded the possibility of leaning too heavily upon the preliminary findings or conclusions of experimentors, and of the inclination of quoting the mere opinions of Drs. Y or Z who see through a species of self-hypnosis, things from a point of view to suit their opinions, with the result that they offer in evidence opinions only—but no proofs. We shall prove that the conclusions at which Dr. P. N. W. has arrived are not only vague, but erroneous.

He concludes: "The shape and size of the mouth are determined by the underlying structures, chiefly the six anterior teeth." That is just as true as it is untrue. The establishment or affirmation of this hypothesis is no stronger than its negation.

A lot does not determine the building we erect thereon. The kind, the quality, and the distribution of the building material, the architect, etc., are factors in the equation of the ultimate results; and we must not forget the purpose for which the building is intended.

"The underlying structure," assuredly, has some relation to the mouth, as it has, also, to the distribution of the teeth: and so too, has the lot to the building.

The protruding and retruding jaws give us conclusive proof. Between the jaws and the teeth and the tongue, etc., there exists a very complex coordination. The relationship will be perfect, if the denture has fulfilled all the requirements which nature has prescribed. It is subject to doubt that a perfect denture has ever been discovered and discerned as such.

On the other hand it may be possible to find six near perfect dentures of six quite different types, or races as the case may be; let us say; Negro, Mongolian, Indian, Aryan, Semite, American, the last mentioned having been discovered, evidently, by the author of "Determining the Shape of the Normal Arch," and his handicapped professional precursors.

It is to be expected that the underlying structures of the six enumerated "types" vary greatly, *i. e.,* that the distribution of bone and other tissue differ considerably—and so also the formation of the mouth in general.

If we take these six hypothetical cases for our investigation, and measure the tooth material and different chords of the arch, we may find the arches

alike (or geometrically similar) and the tooth material different (or not proportional) or the tooth material the same (or proportional) and different arch form (not geometrically similar) or different tooth material and different arch form.

If we were of the old school we would no doubt be able to prove that the arch form changes with the race of man, because after being lucky enough to have discovered six near perfect dentures we expect more—to have discovered six dentures, typical of the race to which they belong.

We do not hesitate in assuring our contemporaries that dental engineering can provide an analysis convincing, conclusive and absolute—of all six cases.

We may venture to say that distorted arch forms frequently occur though the jaws be fundamentally normal, and that immediate underlying structures may be severely disturbed by the very teeth, whose positioning these underlying structures are, supposedly, to direct, which process may be accounted as one of natural reaction.

Such cases of malocclusion yield easily to treatment. They are the pièces de résistance" in the orthodontist's model case, and very often, be it stated, he does not know the exact reason of his accomplished success.

The six anterior teeth, as an individual group, have a very small share in determining the arch form. Their relation to the lower anterior group is a determining factor in generating the anterior curvature. And this very relation is a capital function.

Some of the reciprocal factors which participate in the molding of the dental arch form are: Labio-lingual distance of the C.C.C.'s at the median line, and the bucco-lingual distance of the C.C.C.'s at the cuspids, the tongue and the lip pressure, the underlying structures, the condyle path, the food we masticate, habits of living. There are others.

To assume the ratio 14:9 to be the distinct American type is very far-fetched, and risky inasmuch as the ratio 14:9 is the mean average of, probably, all upper arch forms, of the species *homo sapiens.*

We have no absolute proof but, if the *belief* of the author of "Determining the Shape of the Normal Arch Form" is correct, it must be so.

He quotes:

"There is no anatomical part in mammals so uniform as dentition. Even between primitives and man there is a striking likeness of the shape of the jaw. Teeth make the arch, and the species' variability is so small in a racial type that it requires careful measuring to detect the difference in shape."

The quotient "9" in the ratio

$$\frac{14}{9}$$

decreases, (for a given tooth material), and a constant first molar buccal groove distance, with the decreasing ratio

$$\frac{T_{l_i}}{T_{u_i}} = \frac{\text{Lower incisal tooth material}}{\text{Upper incisal tooth material}}$$

The quotient "9" also decreases with the decrease of the overbite and in-

creases the more the tooth axes of the incisors approach the vertical to the lateral plane, etc.

The 14:9 ratio as a working basis is open to serious objections.

In the hands of most practitioners it is a dangerous toy,—just as mischievous and dangerous as any other arbitrary arch form; as for instance, the mechanical determination of the arch form which has been brought into the foreground lately, and which, instead of producing *the* arch form, is nothing but an arbitrary method of generating *an* arch form.

The arbitrary arch form and the arbitrary arch form determination, are very useful, theoretically, in the dental school, but neither can be considered worthy of direct application in the practitioner's office.

Dental engineering has proved that the employment of empiricism is not consistent and conscientious, scientific practice, and that certain arbitrary methods, while they may add to the comfort and the coffers of the happy-go-lucky practitioner who does not see his mission, or seeing it, buries his head —ostrich like—in the sands of complacency, must eventually prove a boomerang to the profession.

Let us assume, the mean average ratio, were

$$\frac{A}{B} = \frac{14}{9.}$$

This would be very interesting, though not important. It certainly is of no value to the orthodontist, unless he is anxious to build up a preliminary arch form, to be used as a step toward the better arch form.

He may so proceed, but safely only if he understands dental engineering.

Let it be noted that for the purpose of constructing a preliminary arch form, if that were advisable, it is not necessary to *carefully maintain a given ratio in order to obtain a normally shaped arch.* It is well to be careful. We do not yet have such a thing as a normally shaped arch, identified as such, and it may forever remain the Messiah of the realm of arch forms.

The dogmatic ratio, $\frac{14}{9}$, is erroneous; more so the ratio

$$A : B : C : = 14 : 10 : 9.$$

Were the latter correct, then it may be arbitrarily extended on its own merits to:

$$A : B : C : D : E : F : G : = 14 : 10 : 9 : 7.07 : X : Y.$$

where X = factor for the incisal radius,
Y = factor for the tooth material.

The reader is referred to Fig. A.

But fixed relative values of a few of these factors would result in the necessity of various types of arch forms, geometrically similar. Diligent research will enable us to find arch forms which can be classified within certain geometrical figures, but we shall find all races more or less represented in all classes. Consistent research will be certain to definitely determine that the distinct American type which the author of the article referred to imagined he had discovered does not exist, and we prognosticate that such "distinct Ameri-

can type" will be found to be distributed *with* the "types" of western and central European races, amongst the arch forms of man classified according to their geometrical forms.

He concludes:

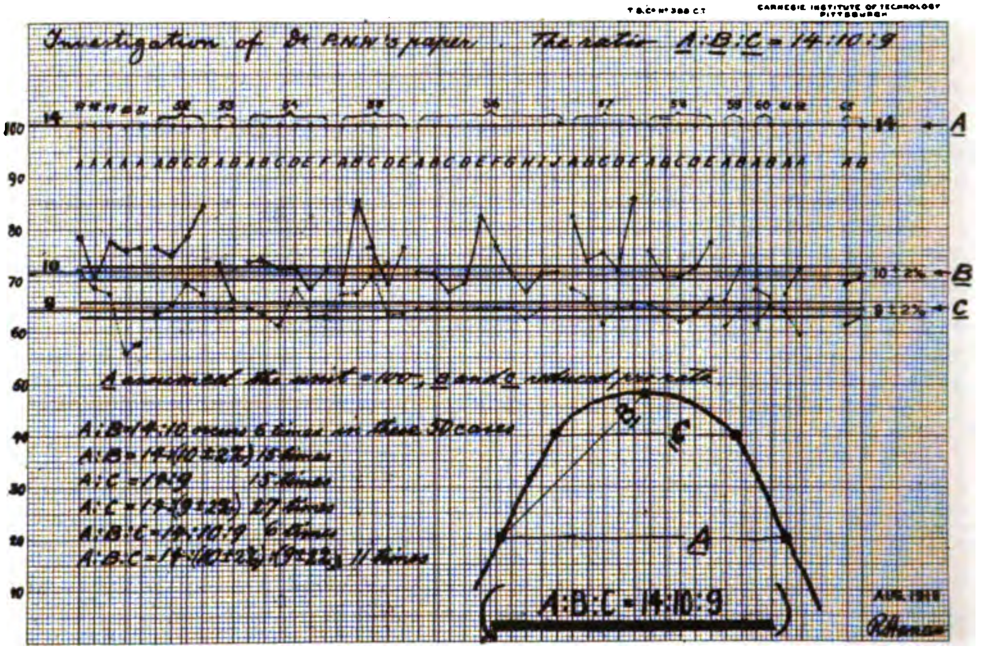

Chart I.

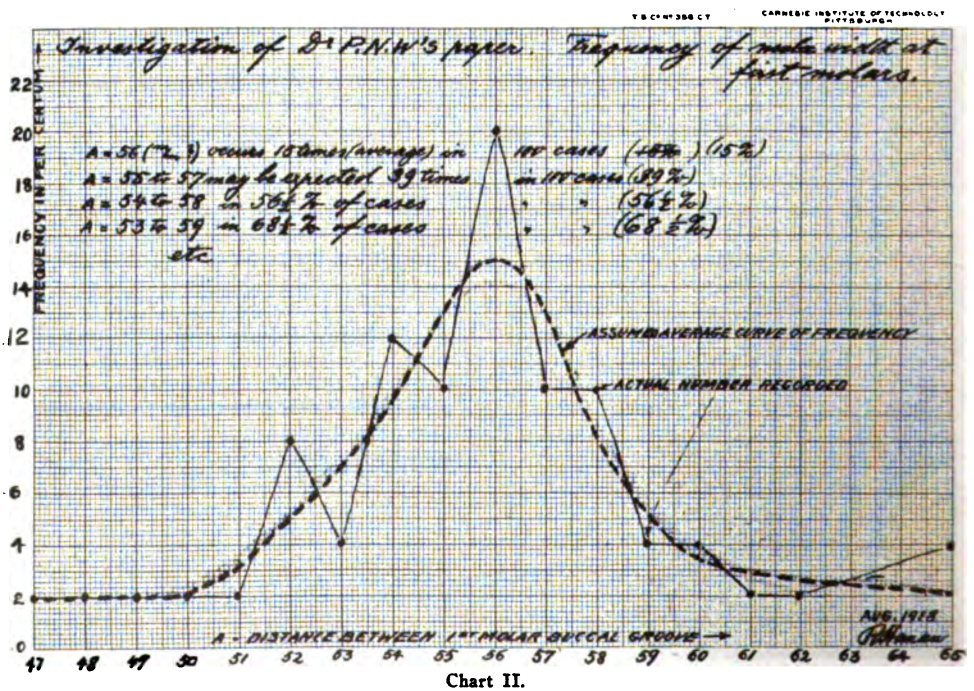

Chart II.

Many arches are badly deformed, because of lack of knowldege "of fundamentals and correct technic."

He is right.

"Arches that are not natural in shape can never be retained." That means nothing; because we do not know what is "natural in shape."

Let us assume we have an arch: the upper laterals are extracted, or that there is a supernumerary lower incisor. Can such arch form never be retained? Or, if it be retained, is the arch form natural in shape?

Charts I and II are plotted from the table of measurements which Dr. P. N. W. gives in his own paper. His own designations A. B. and C. are adhered to.

In Chart I the arches are arranged in groups according to the distance A. The values B. and C. are reduced to A=100, and entered accordingly. The conclusions are added in writing.

The Chart II, if extended over a great number of cases, may lead to some

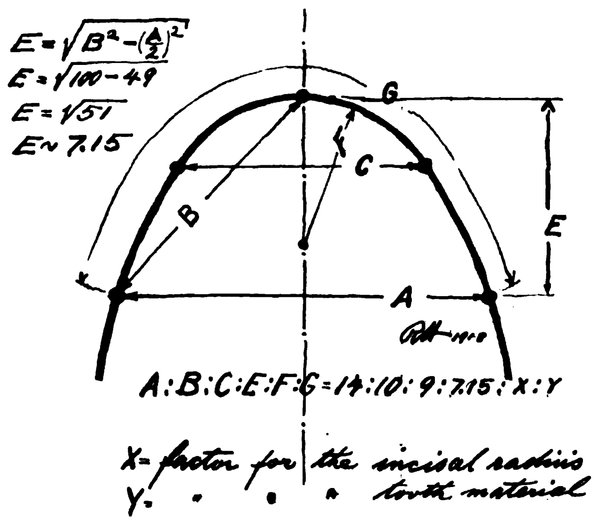

Fig. A.

interesting findings: the frequency with which a width of arches at the first molar buccal grooves occurs also, at its maximum, its minimum, and its "normal" width. By the latter we do not mean the mean average, but, rather, the most frequent widths. The latter is of more interest to the anthropologists, than of importance to the orthodontist.

We assumed that the measurement tabulated by Dr. P. N. W. are correct, yet we must conclude that his findings are *erroneous*. There seems to exist, in the minds of a few, the opinion that engineering and esthetics could not, very well, be combined. Engineering has passed that embryonic period decades ago.

As a dental engineer I wish to show that neither scientifically nor philosophically am I opposed to nature and beauty, by freely acknowledging my admiration for the good taste Dr. P. N. W. exhibits between the lines 8 and 9, column 2, page 488, volume LX of the *Dental Cosmos*.

HOW FAR CAN A TOOTH BE MOVED WITHOUT DESTROYING THE PULP?*

By F. C. Rodgers, D.D.S., St. Louis, Mo.

Professor of Orthodontia, St. Louis University Dental School.

During the course of treatment of orthodontic cases, teeth often have to be moved bodily to varying distances in order to bring them into normal occlusion. The question has often occurred to me, "How far can a tooth be moved without destroying the vitality of the pulp?" Recently, a case was presented to me for treatment which offered an opportunity to answer this question.

The patient was a young miss of fourteen years, with all the permanent teeth erupted in normal occlusion except the upper left cuspid which was impacted over the buccal roots of the upper first molar and lying diagonally across these roots. The tip of the cuspid crown erupted just through the gum to the mesial

Fig. 1.—Note tip of cuspid protruding through the gum above the second bicuspid; outline of root indicated by pencil mark on model.

Fig. 2.—Occlusal view, cuspid moved mesially, crown portion fully exposed.

of the buccal cusp of the molar and the apex of the cuspid superimposed over the distal root of the molar. (See Fig. 1)

The problem presented for solution was, to move the cuspid bodily from this impacted location past the two bicuspids into its normal position. The case was further complicated by the location of the tooth which made it impossible to attach an appliance. (See Fig. 1.) The survey made on the model shows the distance that the apex of the cuspid had to be moved. (See Fig. 4.)

TREATMENT

The first stage of the treatment was started with a Jackson removable appliance, consisting of a delicate spring wire curved up over the gum, distal to the second molar and made to bring pressure mesially against the cuspid root

*The models were exhibited at the Clinic of the American Orthodontists' Society Meeting, Edgewater Beach Hotel, Chicago, August 1, 2, and 3, 1918.

at the junction of the crown. Active force for moving the tooth was obtained by repeatedly opening the loop of the spring wire until the tooth was in a position as shown in Fig. 2.

At this stage, the position of the tooth began to change from vertical to horizontal, as shown in Fig. 3, which necessitated the use of a different appliance. A band with a root-wise extension (Case) was adjusted and cemented on the crown. An alignment wire anchored on the molar teeth was used to hold the cuspid crown in position, while moving the root mesially by means of sea-grass ligatures which were attached to the root extension on the band to a spur opposite the central on the alignment wire.

Fig. 3.—Buccal view, root plainly outlined on the gum in a horizontal position. Tooth very loose.

Fig. 5.—Occlusal view, same case, also showing retaining appliance on the lingual.

Fig. 4.—Buccal view, showing cuspid tooth in normal position. Survey shows distance tooth was moved. ($14/16$ inch).

The stability of the tooth at this stage was in a precarious condition; it was held in place by a thin layer of gum tissue over the root; the apex was almost exposed, while the crown had to be supported and held in position by the alignment wire. The vitality of the pulp, up to this stage, was normal; it responded to thermal tests.

Figs. 4 and 5 show models of the case with the cuspid tooth in its normal position. Further treatment was suspended on account of the summer vacation and in order to give nature a chance to stabilize the tooth by regeneration of peridental fibers and a deposition of the bone around the root. Fig. 4 is a model showing the case at the present time.

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EDITORIALS

The Removable Lingual Wire With Finger Springs

IN the April, 1917, issue of the JOURNAL we published an article on "The Band and Lingual Arch Technic," by Dr. John V. Mershon, of Philadelphia, Pa. The article at that time was revolutionary to a large number of men who were unfamiliar with the lingual wire as described. It was only after considerable persuasion that we succeeded in getting the article from Mershon at that time, but having seen his work, we were convinced that the lingual wire as he uses it possesses possibilities equaled by but few appliances. Until the publication of the lingual wire as used by Lourie, in conjunction with the wire-stretching pliers, and the removable lingual wire as used by Mershon, most of the orthodontic results were being obtained by the labial wire. It is true Jackson had for a number of years used the removable appliance known as the "Jackson appliance" which possessed a great many

advantages, and which has not received the recognition it should have had as a basic principle in orthodontic treatment.

In this issue, we publish a paper by Mershon, read before the American Society of Orthodontists, which shows a broader technic in the use of the lingual wire and especially calls attention to the use of the auxiliary springs which greatly increase the range of usefulness of the lingual alignment wires. We believe there is no appliance which will produce tooth movement as easy and with as little inconvenience to the patient as the properly constructed lingual alignment wire with the correct auxiliary springs. The greatest difficulty in the use of the removable lingual alignment wire is that of anchorage and the greatest trouble that will be encountered will be in the displacement of the anchor teeth resulting from the operator putting too much stress on the malposed teeth at one time. We have seen several cases where men attempted to use the removable lingual alignment wire and failed to realize, owing to the delicate nature of the force, that the anchorage was just as important as it was in the use of a heavier appliance. Owing to the fact that the lingual alignment wire is smaller than formerly used in the labial wire, improperly fitted appliances can be forced into the tube on the molar band without any perceptible pain to the patient, and the slightest amount of spring in the alignment wires when placed in the molar tube will eventually move the anchor tooth. Disastrous results also occur in the cases where operators allow too long a time to elapse before seeing the patient. Mershon recommends four or eight weeks between visits, which is perfectly safe and feasible, if the appliances are so adjusted as to be working exactly right. However, in the hands of the inexperienced and of those who have not used the removable lingual alignment wire in many cases, we would not recommend as long a period between visits, for in many cases an undesirable force will be present on some of the teeth, and before the patient returns a large amount of undesirable movement would be produced.

The greatest difficulty in the use of the lingual alignment wire is that of anchorage and every care must be observed in conserving the anchorage if we are to obtain the best results from the removable lingual alignment wire with spring attachments. One advantage of the spring attachments is that the force can be exerted upon the malposed tooth or teeth without greatly changing the other teeth or the forces upon the approximating teeth. In order to make the individual adjustment of the malposed teeth or roots possible it necessarily follows that the anchorage must be secure and that there must be a considerable difference in size between the main alignment wire and auxiliary spring so that when force is exerted by the spring, the removable lingual alignment wire will be heavy enough and strong enough to absorb the force without any resulting displacement of other teeth. It is needless to mention that inconspicuousness of the lingual alignment wire is so satisfactory to the patients that they will wear these styles of appliances when they would not wear the old styles or newer forms of labial wires. We do not believe that anything from the standpoint of a mechanical appliance has been given to ortho-

dontia for the past ten years that offers so many advantages as the lingual wire whether used in a removable or the soldered form and believe that those interested in the practice of orthodontia can do nothing which will be so valuable to themselves and their patient as to master the technic of the use of the lingual wire.

The American Red Cross Home Service

THE time will come after the disabled soldier or sailor has received the benefits of the Government's medical and surgical care and vocational training when he will go to work at his old occupation or in a new position which the Government has found for him. Our country will have done everything possible to restore to each man what has been taken and used in the national service. From this time the Red Cross and other community agencies will gradually take over the chief responsibility for such further assistance as the man may need. The rest depends upon the individual and his personal will-power and capacity for recuperation.

For many returned men who will supplement their innate resourcefulness with these advantages, no further assistance will be needed. Others, less forceful and self-reliant, or more seriously handicapped and disheartened, will require some degree of friendly sympathetic oversight and encouragement to carry them through the first critical months until they have found themselves in their new work. This is no work for a distant and impersonal official agency. Rather it is a task for personal friends close at hand and intimately aware of the man's everyday problems and difficulties. This is appropriate work for the Red Cross. It is especially appropriate work for the Home Service Section which in many instances has already had the privilege of helping to maintain intact the standards of health, education, and home life of the soldier's family during his absence.

The Red Cross is strategically well-equipped to undertake the follow-up care of returned soldiers. Each soldier discharged on account of disease or wounds will return to a community where the Red Cross will already have served his family, if there has been any kind of need.

Among the private organizations whose efforts will naturally supplement the national program, the Red Cross occupies a unique position. Its purpose and field of activity are in an unusual degree colored with public interest and controlled by Government authority. With its great financial resources, its 22,000,000 members, its 3,900 chapters and their 15,000 branches, the Red Cross is better equipped than any other private organization to give aid and comfort to our soldiers and sailors and to assist their families at home.

When we give to that noble cause represented by the Red Cross, we know that our donations, be they small or large, will be most wisely spent.

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ORIGINAL ARTICLES

A CONSIDERATION OF SOME PRINCIPLES OF REGULATING APPLIANCES*

BY MARTIN DEWEY, M.D., D.D.S., CHICAGO, ILL.

Head of the Department and Associate Professor of Orthodontia in the Dental Department of the University of Iowa.

REGULATING appliances may be defined as mechanical devices for exerting pressure upon malposed teeth for the purpose of creating cell activity and thereby causing the teeth to assume proper positions in the line of occlusion. According to this definition, regulating appliances must be considered as mechanical devices that produce pressure on the malposed tooth, and this pressure produces cell activity first and then in conjunction with the cell activity it moves the tooth into its proper position. A careful analysis of this definition will result in an understanding of regulating appliances which has not been observed in the past by many manufacturers and men advocating the use of different styles of appliances. In times past regulating appliances have been used and advocated which considered only one part of this definition; namely, the exerting of pressure upon malposed teeth for the purpose of moving them to a certain position. Any regulating appliance that has for its object the mechanical movement of a tooth without a consideration of cell activity will produce a pathologic movement and result in all sorts of undesirable conditions.

Any regulating appliance for the correction of malocclusion is only an aid toward Nature's process of development and should aim to produce pressure on the tooth and create cell activity, and from that time on the movement of the tooth should be as near in keeping with the development which occurs during natural development and tooth eruption as can possibly be obtained. In times

*Read before the eighteenth meeting of the American Society of Orthodontists, Chicago, Ill., August 1-3, 1918.

past the various requirements of regulating appliances have been enumerated, and in the sixth edition of Angle's book we find the following: "Efficiency, simplicity, delicacy, inconspicuousness and stability of attachment." Admitting that these five requirements are essential, there is no question but that efficiency takes foremost rank among the requirements of regulating appliances. Regardless of how nicely an appliance may be constructed, or how beautifully it may work on paper, or how successful you may be in obtaining a patent from the patent office to cover this appliance, if it is not efficient it necessarily will be a decided failure. We recognize the fact that almost any style of appliance which exerts pressure on a malposed tooth will produce some sort of a result. Consequently, men in using appliances which fall far short of the best orthodontic principles have been able to accomplish results, but the appliance has been very lacking in efficiency from a physiologic and mechanical standpoint. In comparing efficiency of regulating appliances, we may say that you are able to travel over the country in a large automobile freight truck and you would eventually complete your journey, but you would be able to travel much more rapidly and with much more comfort in a touring car, and for that purpose the touring car would be considered more efficient for traveling. The automobile truck might have an efficiency for another purpose but not as a pleasure car.

Related to efficiency, which is foremost among the requirements of regulating appliances, I can not help but believe that the stability of attachment or anchorage plays a great part and is a certain factor in efficiency. An appliance may be very nicely constructed and possess wonderful mechanical principles, but if we do not have stability of attachment either to the anchor tooth or the malposed tooth, we necessarily are going to get an unsatisfactory result.

In considering the question of the principles of appliances, anchorage may be defined as a resistance to overcome an applied force. We must also remember that action and reaction are equal, and consequently our anchorage must be sufficient to absorb the force that is going to be applied to the malposed tooth, unless we use reciprocal anchorage, in which case the action and reaction are both equalized by selecting a malposed tooth as the point of resistance. I believe that anchorage is one of the more important things in the efficiency of regulating appliances, and is something which should be considered separately from the regulating appliance during the planning of the treatment. One of the first things to be considered is the point of resistance, and an ideal appliance is one that is so constructed that special attention is given to resistance, which is increased by mechanical principles and plans.

In a great many instances it will be desired to construct an appliance so as to stabilize anchorage and in reality have a portion of the appliance concerned in anchorage separate and distinct from the moving part. Several years ago Barnes of Cleveland called attention to the fact that in using the labial alignment wire, commonly known as the expansion arch, there was a great tendency to displace the molars distally and buccally. It seems to me that the majority of orthodontists practicing at that time did not pay enough attention to Barnes' contention, for a number of results show that men were moving molars distally and buccally by displacing their anchorage. The reason for this is that the nat-

ural tendency of the labial alignment wire when used to expand the arch and at the same time move the incisors forward is to exert a distal and buccal force on the anchor tooth. By using the ordinary molar clamp band or single attachment upon the molars, there is no provision made to prevent this distal and buccal movement except the supporting tissue.

Now, as an example, the efficiency of such an appliance can be greatly increased and the anchorage stabilized if the molar on the right and left sides was attached to a lingual wire, which lingual wire would not be used to move the molar, but simply be used for stabilizing the molar anchorage. This lingual wire could also be so constructed and used as to produce the molar expansion, and the expansion of the molar could be under the influence of the lingual wire and in no way be affected by the labial alignment wire, which is producing the movement of the rest of the malposed teeth. As a result of this, I believe that one good principle of regulating appliances is to have a separate attachment upon the anchor teeth, whereby one can control them independently of the rest of the malposed teeth.

It may further be said that any regulating appliance will be increased in efficiency as it is constructed so as to allow individual tooth movement or individual adjustment. In the last few years attempts have been made by certain men to introduce appliances which could be adjusted at one time and which would move the teeth to the proper position without further adjustment. Appliances have also been introduced which have been made out of small gauge wires for the purpose of exerting pressure upon all the teeth at the same time and moving all of them into the line of occlusion. We recognize the desirability of moving all of the teeth at once, but we also are forced to recognize the mechanical principle that with a bent, curved or looped wire, fitting into brackets or attached in tubes, it becomes practically impossible to exert force on one malposed tooth without changing the relation to the approximating tooth.

As a principle in the construction of regulating appliances I would, therefore, say that an appliance should be so constructed that each individual tooth could be adjusted without destroying or changing the force on the approximating tooth. This factor is one thing which has made the use of the alignment wire with ligatures such a universal appliance. If we had a 16-gauge wire with a properly constructed anchorage and ligatures, by tightening one ligature on the alignment wire we would disturb the approximating teeth very little, provided the alignment wire is heavy enough to absorb the force from the tightened ligature.

In other words, an appliance should be so constructed as to have firm anchorage. Then there should be a base wire or part to that appliance from which the force for the individual teeth is obtained. As an example of this, one of the beautiful mechanical principles of the Jackson removable appliance is the construction of the appliance in such a manner that groups of teeth serve as anchor teeth, thereby greatly increasing the resistance over single teeth. Secondly, the appliance consists of a base wire from which the various forces are originated. These various forces are produced by means of individual finger springs which work on individual teeth and on such teeth as need to move in a

certain particular direction. In adjusting these appliances to exert increased force, the finger springs can be adjusted to exert pressure on a single tooth or group of teeth, and without disturbing the base wire. Therefore, no undue stress has been brought to bear on the anchor teeth as the result of changing the entire appliance; neither has one group of teeth been disturbed by adjusting or increasing the pressure on another single tooth.

I would, therefore, say that as a general rule regulating appliances should possess three distinct mechanical parts or plans: First, some means of procuring the anchorage, then having that anchorage under absolute control. Second, the construction of a base wire from which the force is exerted and, third, some sort of attachment to that base wire to exert the pressure on the malposed teeth. These are three things which must be considered, and if it is possible to obtain these three things in a simply constructed appliance, so much the better; but if the malocclusion is very extreme it will be necessary to greatly change the appliances from what has been used in times past in order to follow out these principles.

It is possible to follow out these principles with a removable regulating appliance, and the same thing can be obtained with fixed appliances. An example of fixed appliances which control the anchorage and which furnish a base from which the force is applied to the malposed teeth, and which furnish individual tooth attachment is such an appliance as was advocated by Lourie at our last meeting; namely, by using plain bands upon the molars, a lingual alignment wire soldered to those molars we are able to utilize that lingual wire for the purpose of controlling the molar anchorage, and also by proper manipulation can move those molars in various directions. Now this lingual wire will control the molars absolutely and should be utilized in a number of cases for no other purpose. However, with the proper construction of the lingual alignment wire it will not only be possible to use wire to control the molars, but it will also be possible to make various tooth movements in the other parts of the mouth.

As a means of exerting pressure from the lingual alignment wire upon individual groups of teeth, the finger spring as used by Dr. Mershon, is good. The use of the finger springs upon lingual alignment wires affords a means of exerting force upon malposed teeth by using the lingual wire as the base wire, which can also be used as a means of stabilizing the molars. In using the finger springs upon lingual wires, following out our mechanical principle, the finger springs should necessarily be of a smaller gauge than the alignment wire, so the lingual alignment wire will be capable of absorbing all the force from the finger springs and not be distorted and therefore exert pressure on teeth when that pressure is not desired.

I have called attention to the fact that as a principle of regulating appliances is the stabilizing of the anchorage, that the lingual alignment wire can be used to stabilize the molars and used for that purpose only. Then as a means of exerting pressure upon the malposed teeth, I would recommend the use of the labial alignment wire, and for reasons of inconspicuousness would say that the labial alignment wire should be placed high, or gingivally, out of sight, as shown by Doctor Lourie in his paper at Excelsior Springs. Now this labial alignment

wire becomes the base wire on which force is exerted, and the force to the individual malposed teeth is again exerted by means of finger springs in whichever direction it is desired. Now in order that individual force can be exerted by means of finger springs upon individual teeth, the finger springs are made of material, say 24 or 26 gauge, while the labial alignment wire is made of material 17 or 18 gauge. This difference in gauge between the size of the labial alignment wire and the finger spring makes such an appliance that pressure can be brought to bear upon individual teeth, and this pressure will be absorbed by the larger labial wire. The resistance of the labial wire will be obtained from the anchor teeth, which have been stabilized by means of a lingual alignment wire.

In times past I believe appliances have been constructed in which too little attention has been paid to the anchorage. An appliance should be so constructed that pressure can be exerted on malposed teeth without disturbing or changing the anchor teeth. This can only be done when one has the anchor teeth stabilized, or has some means of absolutely controlling the teeth to which the attachment is made.

Another principle which I wish to mention is that no regulating appliance should be so constructed as to be universal for various cases. Advertisements have appeared and articles have appeared as scientific papers, in which men advocated the use of one style of appliance for every type of malocclusion. Advertisements have also stated that if this appliance is placed on the teeth it will do the work. Such things are very misleading, and any appliance which carries out the idea or information that malocclusion can be corrected by a single adjustment is a very good appliance to let alone. We must remember that a regulating appliance exerts pressure on malposed teeth for the purpose of creating cell activity, which therefore means that we are dealing with physiologic tissue, and this tissue will not respond the same in different individuals, even though the malocclusions are of a similar type. Also, any regulating appliance which exerts enough pressure on a malposed tooth in the beginning of the case to carry this case to completion is a dangerous thing to use.

Another feature or principle of appliances is that the appliance should exert force on the tooth so as to move the tooth physiologically. Any tooth which is being moved physiologically will be moved painlessly. As a result of this it becomes necessary that any appliance that exerts pressure on a tooth must do so without producing pain. Pain is absolutely unessential and unnecessary. It is to be avoided and can be avoided by the proper construction and use of the appliance so as to exert the proper amount of force. Pain is always an indication of faulty technic, which may be caused by improperly constructed bands, or the improper application of force, and any appliance which does not move teeth without pain is not moving them physiologically.

In closing, I will say that if we consider appliances from the standpoint of the definition and what they are to do, and remember that we have certain mechanical laws which must be observed, a large number of appliances will constantly be cast into the discard because they fail to come up to these mechanical principles.

DISCUSSION

Dr. William G. Law, New York City.—I have not very much to say after the discussion yesterday and the principles of appliances having been so clearly stated in Doctor Dewey's paper.

There are a few small points which to me are exceedingly important which accompany the ideas presented concerning the underlying principles of regulating appliances, and while efficiency of course is the main thing to be considered in all work we undertake for our patients, efficiency is a very big word. Beauty lies in the eyes of the beholder, and it has always seemed to me that the appliances which we should use should first be made as beautiful as possible and as inconspicuous as possible. It has been my experience that patients do not like the looks of any kind of appliance, and the first thing we should decide in selecting either a metal or alloy appliance is, which is the least conspicuous. The formation of the bands which are used on the anterior teeth should be of a form that lends beauty, and the appliance which covers the labial surfaces of the teeth, if one is used, should be made so close to the teeth and so small that it does not interfere with the movements of the cheeks and lips. Dr. Rogers has brought this out in his paper showing the necessity of allowing the teeth and lips to have free movement. On the inside of the mouth this is quite true of the tongue, and the smaller the appliance, in my experience, and the closer it lies to the gingival margins, the more the tongue can have free movement and free function. The smaller the appliance used in every case consistent with the strength of the wire, the nicer the result. Naturally we must think of a wire that has a character, that will not lose its force in the action we undertake. We fortunately have today wires which we can use in the small gauge and band material which can be used in a thin gauge that answers every purpose much better than thick bands or large wires.

As to the question of cleanliness in the mouth, where an appliance is left in the mouth for a considerable length of time and one can not see the patient often, the appliance should be constructed in a way that the patient can keep the teeth comparatively clean. Unless this is done, we have the chance of having disagreeable results, and what is the use of regulating teeth and putting the mouth and face in harmony if the teeth go to pieces under our appliance? So not only should the appliance be constructed from the standpoint of efficient work, but it should be beautiful and it should be cleanly. I believe all of these points can be brought into every appliance for every case that we treat, whether the patient is three or sixty years old! Older patients' teeth move apparently as easily as younger patients' teeth. It takes a longer time to accomplish a great many of our movements. The teeth move. The muscles themselves move, if not counterbalanced by other muscles. We move the teeth in any direction, the muscles pull or press upon the teeth. That is shown in a great many cases where there has been loss of the tongue or loss of bony tissue of the part or where abscesses have occurred or injuries have occurred on the face in the neighborhood of the jaw, where the muscles have contracted and drawn the bony structures and teeth with them all out of position.

Dr. Rogers showed how the muscles through proper and normal occlusion develop the jaws and develop the face without the aid of any appliance; and others with the aid of small, gentle, coaxing appliance, with the aid of the muscles, have shown that results are in proportion to what we knew some years ago, very gratifying!

The door is opening, it seems to me, in orthodontia, so that we can see clearly into the future; that we have a field and the opportunity in the future to do work with the smallest amount of discomfort to our little patients. We can work on younger patients than we thought before. We can do these things with smaller appliances, seeing the patients less often, and with less discomfort and a much more comfortable sensation in the mouth for these little patients than we ever thought before, and the principle underlying all appliances, underlying all efficiency, should be the absolute control of every tooth that the appliance touches, whether it is a molar, or whether it is a tooth to be moved, aside from the molar.

I believe that the large bands which have been used to attach a labial appliance to the molars by screws and tubes are disappearing, and that is to me a great advantage in cheek freedom. Even if we are compelled at times, as we are and always will be, to use a labial arch of small gauge, we can use a small tube, one that lies close to the molar band and will not interfere with cheek movement, and will produce absolutely no discomfort to the patient. It will be nearly the same as though no labial appliance was present. The larger the labial appliance, the more discomfort the patient experiences, and the less

labial appliances we are compelled to use, the more comfort the patient will have. I believe we will succeed in the future in controlling and correcting all of our malocclusions with lingual appliances, and then the ideal will nearly have been reached, and the amount of control in the corrective work that is necessary from labial appliances will be so small and so inconspicuous that there will be no disadvantage in having to use them, and they can be used in a sort of removable appliance which will not have to be worn all the time and can be removed as we direct for cleanliness and also for the esthetic appearance.

Dr. Ray D. Robinson, Los Angeles, California.—I have a case to show at this meeting, and I believe it would be quite apropos to put the slides on at this time in answer to Dr. Dewey's criticisms which were leveled at the appliance with which the case was corrected and which I showed the society some years ago, and if I may have your permission, Mr. President, I will show the case at this time.

Dr. Dewey made some statements to which I must take exception. He said that "if the force is sufficient to move a tooth the full distance which it must travel, it is too severe in the beginning." I grant Dr. Dewey it may be so with the appliance or appliances he uses, but it is not so with the small appliances. It is possible to use an appliance made of .020 wire which will move a tooth over a great distance without at any time exerting more than a fraction of an ounce of pressure. That is the basic principle of the little wire. It can be so adjusted that it will continue its slight pressure for a long time and over a longer distance in space. I hope that point will be taken home. I hope you will understand exactly what I mean when I say that.

Another statement to which I wish to take exception, which was made by Dr. Dewey. His statement was: "that all types of cases can not be handled with the same type of appliance." Maybe he can not do it, but I attempt it at least. I have used nothing but the .020 wire for a number of years. Another thing I wish to say to you is this, that Dr. Dewey is quite unfair when he refers to the multiplicity of loops and twisting of the wire. Dr. Dewey is very well informed that such has not been the use of my appliance for more than two years; Dr. Dewey has been informed on that point for nearly that length of time. I will remind him that Dr. Sweet showed him some models with this appliance on, in Dr. Beaser's office, and he talked with Dr. Sweet for more than an hour and Dr. Sweet told him I had given up the loop and the appliance was put entirely inside. I also brought that out in the paper I read last year, yet Dr. Dewey in his book, which was published long after his talk with Dr. Sweet, speaks of the labial appliance with a multiplicity of loops. In fact the part of his book having to do with my appliance is almost an exact reprint of a paper read and published in 1915.

In view of the fact that I have admitted before this body and other societies, that the appliance as shown at the Toronto meeting was faulty and that the anchorages were not as stable as could be desired and in view of the fact that Dr. Dewey had full knowledge of these things it is unfair of him to come here and criticize that appliance as advocated four years ago, and to publish in his textbook, as my appliance, a form of appliance which he knows is obsolete and has been abandoned.

The case I wish to present in answer to Dr. Dewey is shown in Fig. 1.

I believe that we all have cases come to our attention in which the amount of tooth movement necessary to establish normal occlusion is so great that we are in doubt as to the advisability of undertaking the correction, I must plead guilty to hesitancy in many cases, and this was one that caused me to hesitate. The amount of work necessary and the age of the patient, and the chance of a successful issue were all unfavorable and I at first refused the case. The parents however were insistent and, as I was anxious to try the small wire on a case requiring radical tooth movement, I undertook the work. This was done, however, with full understanding on the part of the patient and her parents that it was to be an experiment with a new type of appliance.

I think you will agree with me that in such a case as this there can be hope of but little posterior movement of the mandible, and that practically all of the movement must be a movement anteriorly of the maxillary teeth. If you will observe you will see that to accomplish such a movement it would be necessary to move the maxillary incisors and cuspids into a position where they would be entirely outside the alveolar process by as much as half an inch. Yet that is exactly what was undertaken.

The lingual arch was adjusted in the upper and a full year was used to accomplish the required expansion. After this bands were adjusted on the upper right cuspid and central and a short wire with a loop was placed between them to secure their separation for

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

the accommodation of the lateral. After this space was wide enough an arch was placed on the labial side of the cuspids and incisors in such a way that it would exert pressure labially on the apices of their roots and at the same time a loop was dropped lingually to engage the right lateral and exert pressure to bring it into its proper position. After it was nearly into such relative position the intermaxillary rubbers were applied, as in all cases of mesial occlusion, and the correction was finally completed in a little more than four years after it was first undertaken. Figs. 2, 3 and 4 will show what was accomplished. The right maxillary lateral was moved more than three-fourths of an inch. All of the incisors and cuspids were moved into a position which at first was outside the line of the alveolar process, and an occlusion was established. Whether the occlusion is normal or not is for you to judge.

I feel that you are asking what the condition of the teeth is at present, whether they have any bony support, whether they are vital, and other similar questions, and you have the right to ask such questions. A look at Fig. 5, which was taken just before I left Los Angeles, will, I think, answer your questions. If not I will say that the teeth are as solid as when I first saw the patient.

Now, gentlemen, if the .020 wire will do that, why use larger wire? It has done it, and there are men here who have been in my office and have seen the appliance working in the mouth. Your president is one of them. When the .020 wire does these things, I say why use the larger ones? I just want to leave that question with you.

Dr. Ralph Waldron.—I would like to ask Dr. Robinson if any magazine has ever published an article with illustrations on this appliance he speaks of which is applied on the lingual and not on the facial surfaces of the teeth. I follow the dental literature very closely and do not recall seeing such an article other than the paper he read before this Society at Excelsior Springs, Missouri, last year, and that paper was not illustrated, nor the technic described. It was a paper entitled, "Further Experience with the .020 Arch Wire." His paper was a plea for the use of lighter arches and was very timely, but it does not refer to a lingual arch, nor does the discussion of this paper have any such reference.

I assure you I supposed Dr. Robinson's work was all done with the arch he showed us at Toronto, except with modified seats and blocks, and less exaggerated loops, and I can imagine Dr. Dewey was of the same opinion as myself. Therefore I think (putting it mildly), Dr. Robinson has been a little severe in his discussion of this paper, as far as his assertion of Dr. Dewey being unfair.

Dr. Robinson has shown us a most remarkable case, and deserves a great deal of credit, for he has obtained a most satisfactory result, but I would like to see the appliance and learn his technic, and I hope he will give us a paper in the near future showing his *modus operandi* more in detail than he has in this discussion.

Dr. Allen H. Suggett, San Francisco, Califorina.—After seeing Dr. Robinson's appliance and his method of using it, I began two or three years ago to use the small wire, and I experimented cautiously with it for some time, and at first I was as gingerly about using it as we were a few years ago in coming down to the .030 wire that Dr. Angle recommended with his tubes and pin. I thought it was so small that it would not expand the arch, and Dr. Young gave a clinic and explained this wonderful little wire that would move a tooth. As we were all from Missouri, we had to be shown. Every one doubted that a tooth could be moved or an arch expanded with so small a wire after we had been using 16 gauge. When Dr. Robinson came to my office and gave a clinic on using .022 wire it seemed so slight that it seemed trivial; it seemed almost nonsensical that one could move a tooth with it. In using it as we used the old Angle wire, where we had a multiplicity of bands on centrals, laterals and cuspids, we had much more force than in the .030 wire, because with the small loops we could have a larger movement of the wire. It could be bent in to the tubes so that by the time expansion was had one would have movement twice or three times the width that could be made with the shorter wire. Dr. Young, at the time he gave his clinic, said one could expand that the thickness of the material in the tube, which is so small that, it seems to me, it would take a thousand movements to move a tooth in a case like that shown. With the smaller wire one can move it without any particular measurement, and as it is sprung into place there will be some bow in the wire and the wire will come down to the smaller circle, but the expansion will carry on the case for a long time. In the movement of the contiguous teeth we had a much larger amount of spring going on than we could get in the .030 wire. Dr. Robinson went us one better than that. He began to use .020 wire instead of

.022 wire. I have been using that on practically all cases since, and we finally came down to the multiplicity of bands on the molars and cuspids with the lingual wire connecting to take care of the bicuspids, but gradually we have been drifting down to the use of fewer bands

In the last year or so, I think there has been a general drift towards the lingual wire, and we find there we have a great deal more strength in the small wire because of the shorter distance inside the arch than outside. We find that small wire will do the work and do it so comfortably and so easily that we are getting away from the use of ligatures because it is much easier to take care of the teeth, and I find that as we learn how to use the wire and follow the directions Dr. Robinson gave us, to let it alone and stop tinkering with it, we get much better results. His instruction was given to let it alone for a month or two, and then we would get along much better, and we will get the expansion and get it comfortably.

When I first began a case with 16 gauge wire I lost control of the anchorage in the first years of practice. We soon found out how much we could abuse our anchorage. Very few have trouble with anchorage now.

So far as using the small wire is concerned, when it is bent in it will be crowding the opposite direction in the molars from the direction desired. If we brought pressure on the bicuspids, we would tuck in the molars, that is due to excessive pressure. We get it in the same way with the larger arch. When heavy pressure is put on the bicuspids with ligature, the molars are pulled in just the same. It is a matter of degree, and we soon learn to handle that. As we perfect this in the lingual wire, as Dr. Law just said, we will get away with all the unclean conditions we have with the older appliances and get rid of the buccal tubes and large wire which is so hard to handle, and also ligatures which are so unclean.

Dr. F. C. Rodgers, St. Louis, Missouri.—The question has often occurred to my mind as to how far it is possible to move a tooth bodily. What is the maximum distance a tooth may be moved bodily with safety?

About two years ago I received a patient in my office in whom there was a malposition of a canine tooth. It had malerupted opposite the buccal surface of an upper molar. The tip of the canine protruded beyond the gum tissue just opposite the mesio-buccal cusp. The root or body of the canine extended distally, so that the apex of the root was opposite the distal right molar. The problem which presented itself to my mind was this: In order to move that canine into its proper position, it had to be moved bodily across the mesio-buccal root and over the surface of the two premolars. I was unable to decide whether such a movement was possible to accomplish. I inquired of several men who had been in practice a good many years, and the replies I received were not very encouraging. However, I attempted the case and up to the present time it is not yet completed, but I have succeeeded in bringing the canine into its proper alignment, into proper occlusion, past the premolars. I have a series of models showing the case from its beginning up to the present time. I am retaining it now in its proper position. There is no further stress of movement at the present time and I am holding it and allowing nature to reestablish normal conditions around the roots of the tooth. With the society's permission, I would like to show these models at the clinic tomorrow, although I am not down on the program for a clinic.

Doctor Robinson.—I would like to have Dr. Rodgers describe the appliance he used to do this, inasmuch as this is a discussion on appliances.

Dr. Rodgers.—I did not use any one type of appliance. I used a combination or modification. I first started movement of the tooth out of the alveolar process and its impacted position in the molar region with a Jackson appliance. I made the Jackson lingual appliance with the loop wire extending distally to the second molar, that is. curved around the second molar from the labial to the buccal with the loop, the end of the loop wire being raised against the surface of the canine. That gave pressure from distal to mesial. It was impossible to put any attachment up to the canine in the position it was in, so that this wire penetrated through the gum tissue through its own force, and rested against that tooth, and in three month's time I noticed considerable movement mesially, although it did not move bodily. So I made various changes in the loop of the Jackson appliance until I got bodily movement sufficient mesially, so that the crown portion of the canine tooth was passed beyond the gum tissue. After that I made a band attachment fitted to the canine crown portion, then with the Case system of extending gum expansion from the band and the lower extension to the tip of the canine crown, I got

reciprocal movement, moving the canine bodily with the gum attachment and holding the crown portion in its position until I got upright movement of the canine. By that time it was opposite the first premolar. I could continue then with this sort of appliance, making various modifications because complications had set in at the time. The canine had entirely passed beyond to the alveolar process and was only held in position by gum tissue. As a result it was very loose and had to be handled very delicately, and it was quite painful at that time on account of pronounced pressure of the cheek and buccinator muscles.

A Member.—What about the vitality of the pulp?

Dr. Rodgers.—That I do not know. I have not been able to find out. I have made tests and I am inclined to think the pulp is alive. The gum tissue surrounding it gives me a false response. There has been no unusual pain experienced on part of the patient. I am anxious to know the condition of the pulp. I have the crown portion protected by this arch, and I am not able to get the response from the muscles I want to get.

A Member.—Have you tried the x-ray?

Dr. Rodgers.—Not yet.

A Member.—Did you try the faradic current on it?

Dr. Rodgers.—Not yet. I have not been able to contact the crown of the tooth with the faradic current. I tried thermal changes, but the response may be due to the natural soreness of the tooth or it may be due to the pulp. I am sorry I can not give you a definite statement as to the condition of the pulp at the present time. I am anxious to know what became of the tissue in the blood vessel in connection with moving the tooth so great a distance.

A Member.—What is the age of the patient?

Dr. Rodgers.—She is a young lady fourteen years of age. On the opposite side we had an impacted tooth, and with that the question of proper alignment came up.

A Member.—What is the condition of stability of the tooth at the present time?

Dr. Rodgers.—At the present time it is not very firm. If I give nature a chance there may be a regenerative process and it will again become firm, but the stability of the tooth at the present time is not very firm. That is why I have a small .020 arch retaining it.

A Member.—Is the root of that tooth placed between the lateral and bicuspid lingually?

Dr. Rodgers.—It is back of the tooth in protrusion buccally. There is beautiful alignment with the gum and rest of the roots of the teeth. There is a little inflammation of the gum tissue over the root portions, but that is what you might expect with such an extensive movement, but the gum tissue from the canine back to the molar is quite normal.

A Member.—Is the bone over the labial surface of the canine now?

Dr. Rodgers.—Nothing but gum tissue. If we let it alone for two or three months there may be regeneration, owing to the cementum and the conditions that are seemingly favorable.

Dr. Dewey (closing).—It seems to me, the gentleman from California (Dr. Robinson) misunderstood the title of my paper, which was "Some of the Principles of Regulating Appliances," and not a consideration of appliances. However, owing to the fact that some of the members have been inclined to bring up the question of appliances to illustrate their remarks and say something with regard to the principles of these things, I will take this occasion to say a few words along that line.

I did not criticize the use of the small wire, the .022 or .020 wire, but if you remember I made a plea for stabilization of the anchorage construction of the regulating appliances separate and distinct from anchorage, and I made the further plea for individual tooth control. Dr. Robinson seemed to think that my remarks were a criticism of his appliance where he used loops. There was no more criticism of his appliance where he used loops, or where he did not use loops, than any of the other appliances, whether it be a labial or lingual appliance. The question of loop in an appliance makes it impossible to have the direct application of force. Whenever you begin to straighten the loop in an appliance, just at that time your appliance may be out of alignment and you produce a change; you lose control, and if you use careful measurements with calipers you are still uncertain as to what force you are producing on the molars.

Now, I made a plea for individual tooth adjustment with finger springs, as was shown yesterday. The loop appliance was shown in one paper which I criticized just as much as the appliance used by Dr. Robinson. With the tube and pin appliance, when you open the loop you change the adjustment between one tooth and you change the approximating tooth. It is impossible to do otherwise. Then if you have a small

alignment wire, labial or lingual, .022 or .020 of an inch, with no other provision to control the molar anchorage, the minute you exert force on the malposed tooth you get force on the anchorage tooth. The fact that you have to use an attachment on the anterior part of the alignment wire to keep it in position is a plain admission of the fact that the thing is tipping. Whenever you tie the lingual alignment wire to the anterior tooth or put it on an anterior band to hold the lingual wire, you are tipping the molar, or the alignment wire is so flexible that it is slipping, and the minute it does that it loses the direction of the force that you gave the .020 alignment wire, lingual or labial. If you use it in accordance with the principle suggested and stabilize the molars, so that you can adjust the small gauge wire to the movements, you will not have reaction on the molars in the direction you do not want it.

The gentleman from San Francisco claimed that I advocated large alignment wires. I advocate alignment wires heavy enough to control the molar anchorage, and I contend that you can not control molar anchorage by the use of .020 alignment wire unless you use some measure for stabilizing anchorage. The minute you bend it in at one point it flexes out at some other point. If you can stabilize the anchorage in some way and use smaller wire, the better it is for you; and it may be small enough to be bent if you have the molar anchorage stabilized; that is all I contended for. My friend from Los Angeles stabilizes his anchorage, and Dr. Waldron stabilizes that anchorage for small gauge alignment wires which is the proper principle, for from there on, you can produce force on the tooth without disturbing the rest of them. The advantage of finger springs over loops in an appliance is when you attempt to straighten out the loops. It does not make any difference to me what style of loop of appliance you consider, it is a dangerous proposition if you try to get force in a straight line.

DEMOCRATIZING DENTISTRY*

By Allen Holman Suggett, D.D.S., San Francisco, Calif.

WHEN England called her first three million men to war, one million of them were rejected on account of their teeth. One million out of three—one-third. This meant that one-third of the English people were unfit—on account of their teeth. At any rate, that's the way England saw it.

England then awakened to a realization of the importance of dentistry.

England had to wake up, and so must Italy and France, all Europe, and the civilized world, including the United States, including the dentists of the United States; including even the American orthodontists.

The American dentist is the leading dentist in the world. Even efficient, self-sufficient Germany had, and still has, an American dentist for the Kaiser; for the Kaiser, the Junkers and the war lords. In all the great capitals, Americans are the dentists of the rich, the aristocratic, and also the scientifically informed. There is no doubt at all about our social and professional standing. We have made ourselves and our country the world leaders in science, art, and in the business of dentistry, and the leading American dentist is the orthodontist.

But this boast is uttered here in this presence, not to boost our pride (and our prices), but to recall very humbly to mind, the reason for our high eminence, and to add to our burden the full weight of the leader's responsibility.

The American orthodontist is the leading dentist in the world because he happens to be practicing and pioneering toward preventive dentistry; not because he is a great and good man, you understand, but because, almost by accident, he finds himself working in the direction in which the world seems to be moving. No matter, his obligation as a leader is, none the less, to lead; not merely to glory in and profiteer upon his chance, but deliberately to accept the leadership, make conscious to himself and to the world the end he is being driven toward and boldly and strategically to organize our very artful science into a socialized social service.

What is the end we and the world are being driven toward?

The idea that is being burned and bled into mankind in this fierce crisis is, that it is nations, not merely armies, that make war; that it is the people, the whole breed, not only fighting men and the favored few, that must be fit to survive—whether in war or in peace; and that hereafter preparedness will consist in the development of a general, all-round good condition of the race. In a word, we are being shot, shelled, gassed, taxed and scared not back, but forward, to the social point of view.

Two million Englishmen rejected for the front in France—the third of the

*Read before the Eighteenth Meeting of the American Society of Orthodontists, Chicago, Ill., August 1-3, 1918.

English people unfit to fight, were equally unfit for the service to which they were sent back behind the lines. They were unfit mentally, physically, morally to fight, to work or to breed, this rejected third, and I can imagine, can't you, the condition of the two other thirds?

The English people are unfit, and the English people are typical.

We have in California a warden, James A. Johnston, who discovered that the "bad men" in his penitentiary, the troublesome prisoners, were practically all sufferers from bad teeth, bad eyes, bad other organs. They were unfit. He had their physical defects attended to, and his troubles with them were over. Most of the "bad" prisoners became "good." They were fit.

Some one spoke of it as "good work."

"Yes," said the warden, pointedly, "it is good work, but too late, too late!"

If it had been done in time, those prisoners might not have been there at all. That's what he meant, this wise warden; he was suggesting the scientific thought that maybe we imprison men and hang them for having a toothache or for not having glasses. He was suggesting that maybe the dentist, the oculist, and the physician may take the place of the warden, and of the policeman, and of the criminal judge, after the war.

And Dr. Ebersole, a truly leading dentist, has suggested how. He has suggested that we deal early with weak or sick children, instead of late with bad men and women.

You know his report upon the experiments conducted in the Cleveland public schools for the purpose of ascertaining the value of healthy conditions of the mouth. It shows that the United States, the leader in dentistry, is as "bad" as England. Ninety-seven and a half per cent of the public school children of this country have diseased or faulty mouths. That is nearly one hundred per cent, nearly three-thirds of our young people.

A series of experiments on twenty-seven children showed an average increase in working efficiency of 99.8 per cent, nearly 100 per cent again. How did he get this result? Easily: "The increase (of fitness) was due," says Ebersole, "to the correction of the faulty conditions of the mouth and the teaching of the correct care and use of the same."

Read the individual records in this report on those twenty-seven cases; remember that they represent millions (nearly 100 per cent) of our children; note well their physical, mental and moral condition before and after the treatment, and you will achieve for yourselves some sense of our opportunities as dentists to beat the hospitals, jails and asylums, and to contribute to the development of a people fit to fight. And, let me say, in passing, that a world of peoples perfectly prepared for war, would be not only prepared also for peace, but they would be too intelligent, too scientifically led, to have wars. For wars are merely bad cases of malocclusion due to determinable causes and therefore curable, whenever we are ready, we scientific leaders to lead to the application to war and poverty, prostitution, vice and crime, of the methods of prevention used now, for example, by us orthodontists.

The Dental Committee of the Bridgeport Board of Health in the report of results of work done in the St. Vincent Orphan Asylum, gives another boost,

not to our pride, but to our sense of useful, optimistic obligation; to practice and to teach prevention.

Dr. Fones had prophylactic work done upon those orphans. Dental nurses cleaned the children's teeth and mouths thoroughly, twice a year for four years. Decay was decreased from 85 to 15 per cent. And the cost, gentlemen, was 80 cents a year a child.

The accompanying table of statistics which this report carries indicates that the mouth is the opening to other evils and to other reforms. I do not want to exaggerate the importance of one profession; but I want to emphasize the importance of the physician, the oculist, and the teacher, and all the servitors of democratic society, but the results of Dr. Fones' care for the mouths of those orphan children do, as a matter of scientific fact, indicate that, not only caries, but diphtheria, mumps, scarlet fever, pneumonia, measles, etc., diminished and finally disappeared from among those children under dental treatment.

	1907 1908	1908 1909	1909 NOV. 1910	NOV. 1910 APR. 1911	APR. 1911 APR. 1912	APR. 1912 APR. 1913	APR. 1913 APR. 1914	APR. 1914 JAN. 1915
Diphtheria	6	2	1	0	0	0	1	0
Mumps,	8	3	10	4	0	0	0	0
Scarlet fever,	17	8	12	8	0	0	0	0
Pneumonia,	3	5	4	6	0	0	0	0
Measles,	24	50	40	25	0	0	6	0
Tonsillitis,	19	16	8	3	0	0	0	0
Whooping cough,	7	2	2	0	0	0	0	0
Chicken Pox,	15	17	10	6	0	0	0	0
Croup,	4	0	0	0	0	0	0	0
Tuberculosis of eye	*—	—	—	—	1	0	0	0
Tuberculosis of lungs	—	—	—	—	1	0	0	6
	103	103	87	52	2	0	7	6

*Work was started in November, 1910, and in April, 1911, the mouth of the last child had been put in order. Study the above table and note that for nearly four years the diseases of children have been practically eliminated. The six cases of measles occurring during 1913 were caused by a new child whose mouth was in a bad condition on entering, and the children infected were all in need of additional dental service. The one *case of diphtheria was also from a new child with bad teeth.*

Dr. Ebersole's results also show striking improvement in general health. These two experiments are leads for us leaders in our leading profession. We are busy upon repair work; we are busy and we are late, like the warden. Dr. Fones and Dr. Ebersole began early—upon children. Of course, they, too, are late. They, too, are repairing damage done. As a citizen, I have been led by my professional training in scientific methods, to see that we must as a nation go farther back; we must begin with the parents and we must correct not only the teeth, but the faulty, disease-bearing social and economic conditions, which depress the families of the American people. Upon that job, however, all the professions must meet and labor together with statesmen and with the people for a scientific treatment of all forms of malocclusion. But today, I am a dentist meeting with dentists at a convention of orthodontists—the leaders of a highly specialized profession. What can we, as leading specialists, lead to?

We can follow and we can thus lead dentists to follow the lead of Dr. Fones, Dr. Ebersole and others, toward the democratization of dentistry and

especially of preventive dentistry. We can support and promote other such investigations, spread some knowledge of the condition of the mouths of the people and of what the meaning is of foul mouths to the public mind, to public and private morals and to the physical strength of the American stock. We shall have to go on with our private practice, doing our belated repair work for the select few who can pay the price determined by a social condition in which the demand for dentists is well nigh universal, and the regular supply very, very limited. And we shall have to go on making our foolish war, I suppose, upon the quacks who are the natural products of the abnormal dental market. War, even the war of the dentists, will continue so long as the causes of war continue. And so the quack, the irregular grafting, painfully painless dentist will continue to maltreat the poor so long as ignorance and poverty exist. But we can see, with our scientific insight, that we can best fight the dental quack by making war upon ignorance and poverty. That is the great war, and our part of that great war is to labor steadily, out of office hours, back of the lines, to induce all cities, counties, states and nations to follow the lead of Bridgeport and Cleveland, Detroit and Buffalo, and the California penitentiaries.

I say cities, counties and states because, as a citizen again, but with a professional eye upon the deeper lying economic problem, I want to see all these problems of democracy solved democratically, by the people, not by philanthropists, not by charity. So I will suggest that along with our individual propaganda of dental knowledge and scientific methods, we urge on the taxpayer, provision for the training of dental nurses to be employed in nurseries, homes, schools and colleges, with dentists to supervise, correct and repair.

This is our special part, as citizen-dentists, in the general social task as I see it; and the experiences of England and of Europe and of the United States Army with soldiers' teeth, indicates that it is a great part. But as leaders, as strategists, we shall be fit and fine, if we remember always in all humility, that our part is only a part of the whole new vision which is breaking through the storm of this dark world war; care for the people, regard for the race, a sense of the need and of the desire for the improvement of the breed of man.

DISCUSSION

Dr. B. E. Lischer.—The very title of the paper to which we have just listened is suggestive of the future, a vision of the dentistry that is yet to be, and it implies that the practice of today is not all that is desirable. Indeed, if one were to formulate an equally terse phrase with similar regard for alliteration, one might speak of present day practice as "Dollar Dentistry."

But "underneath all now comes this word, turning the edges of the other words where they meet it. Politics, art, science, commerce. religion, customs and methods of daily life, the very outer shows and semblances of ordinary objects—

"The rose in the garden, the ax hanging behind the door in the outhouse—

"Their meanings must all now be absorbed and recast in this word or else fall off like dry husks before its disclosure.

"The politician turns round upon himself—like the scientist, he acknowledges his brain baffled by the problems; he reaches his hand for help to the hand of the People;

"The commercial man turns round—the firm ground gives way beneath his feet also; to give now seems better than to get—and what sort of trade motto is that?

* * *

"In all directions gulfs and yawning abysses,

"The ground of society cracking, the fire showing through,

"The old ties giving way beneath the strain, and the great pent heart heaving as though it would break—

"At the sound of the new word spoken—

"At the sound of the word *Democracy*."

Dr. Suggett has called our attention to a number of facts that are fundamental to the formulation of professional policy. The problems involved are very clear and may briefly be stated as follows:

1. Professional policy ought always to be in advance of legislation and should guide the wider applications of practice. Representative organizations, particularly national and state societies and institutions of learning should always regard assistance in this matter as a sacred obligation.

2. The dire need for the extension of dental service *to all the people* has been conclusively demonstrated. "We must search our hearts and confront our traditional optimism with the brutal facts of life as it is." We must universalize *democracy*.

"A few decades ago, we might have turned our backs contemptuously on such a thought. But an enlarged experience of the world and a recognition of imperfections in our own political and social life have made us more humble and thoughtful. We are beginning to realize that democracy has been more a faith than a reality."

3. Educational institutions must be expanded and made more truly representative, and organizations like our own must urge them to advance the status and increase the facilities for the teaching of dental science.

"Institutions criticize themselves by their results, just as do machines, and blindness to the nature of these results can not be expected of rational beings whose happiness is bound up with them. So long as the conservative can not demonstrate that our institutions are perfect, he must expect this constant inspection of the social machinery. It would indeed be strange were it otherwise; the wonder is that, with such obviously faulty results, the amount of complaint has been so small. The reason for this relative paucity of complaint has, of course, been psychological. Very few individuals are able to separate themselves from the institutions of their day sufficiently to step back and watch their working. Such an act requires a certain degree of abstraction, a consciousness of institutions as human instruments which can be changed. Yet this objective, shrewdly critical attitude is becoming pretty general with the increase of education and the growth of democratic sentiment, and bids fair to spread to the masses who have until now been *in* society but not genuinely *of* it. The consequence of all this is the rise of a critical, experimental spirit which is not enamored of institutions but studies them in a scientific way and is little likely to be put off with choleric assertions that man has stumbled upon the best of possible organizations. Every feature of society must, from now on, defend itself before the bar of a reason steeped in facts and hopeful of improvements."

4. The reason why the masses do not now avail themselves of dental service is because the organization of our industrial society has been on an individualistic, *laissez faire* basis, which tends more and more toward "wage serfdom," poverty and ignorance.

As long as we regard human labor as a commodity, and fail to consciously organize the constituent elements of our social and economic life, we must expect disorder, waste, antisocial competition and unmerited poverty; nor can we "hope to tap new energies which are now latent," or "make labor-saving devices really saving of labor," or "procure a fair degree of leisure for each individual," or "achieve a better distribution of human costs."

Thanks to the Reconstruction Program of the British Labor Party, we are now headed toward a new world. "It has electrified liberal America as the speeches of President Wilson have electrified liberal Europe. And if liberal Europe looks to Wilson today as a Moses, we in turn look to the British Labor Party's program as the Ten Commandments. Yet the strength of them is that they are not commandments, nor dogmas, nor final things, but a successful attempt to strike at the roots without attempting the impossible, and to be constructive without being trivial and merely ameliorative. It is that thing for which we have waited so long—a program practicable enough for today and tomorrow, yet radical enough to bring our ultimate destination within view."

"The four pillars of the house that the British Labor Party proposes to erect, resting upon the common foundation of democratic control of society in all its activities, may be termed:

"(a) The universal enforcement of the national minimum; (b) the democratic

control of industry; (c) the revolution in national finance; and (d) the surplus wealth for the common good.

"Is it a dream.
Nay but the lack of it the dream,
And failing it life's lore and wealth a dream,
And all the world a dream."

Dr. R. Ottolengui.—There are two lines in this paper to which I would respectfully take exception. All the rest of it I will merely endorse. The essayist says, "The American dentist is the leading dentist in the world, and the leading American dentist is a good orthodontist." This statement reminds me of the man who had married a second time. About two weeks after the honeymoon, he took his new wife out for a buggy ride, drove to the cemetery and visited the grave of his first wife. Looking down on the grave, he remarked, "She was the best woman in the world. She was the best woman in the world." Wife number two remarked gently, "Charles, you mean she was one of the best women in the world." "No, I mean she was the best woman in the world," and the "honey" part of the honeymoon ended right there.

I would now like to discuss briefly some of the examples as referred to by Dr. Suggett. He calls our attention to the experiment made in Cleveland and gives us some statistics in regard to that experiment. Let me say then, that if we are going to democratize orthodontia, we must not rely too much on that sort of experiment. Experiments should be carried on along lines as nearly parallel to the actual conditions as possible so that the results will be real and not imaginary. We had statistics in regard to the Cleveland experiment which were not literally correct. They were correct as applied to the 27 children, but omitted from that calculation was the fact that at the start there were some 80 or 90 children. Little by little these children dropped out or were left out and only 27 went through with the entire curriculum upon which these statistics were based.

For this reason a new experiment was tried, of which the essayist is apparently in ignorance. This was undertaken by the Second District Dental Society in Brooklyn. We considered the Cleveland experiment inadequate because we were going to talk to the municipal authorities about the effect the dental service would have upon the school system and upon the scholars. To prove anything it would be necessary to conduct an experiment in such a way as to appeal to the municipality as practical. Consequently, we abandoned the idea of inviting a number of dentists, especially skilled, or fitted, or inspired, or enthused, to do this work. Nor did we select a limited number of children who were anxious and willing to go through with the test and then base statistics on work done in that way.

We went to the Board of Health and said, "Here is a list of fifty dentists, located in all parts of the city of Brooklyn. Will you send two children to each of these dentists from any school you please, from a school which would be most convenient for the children? Will you keep their scholastic records before you send them and will you keep their scholastic records during the time of their attendance and will you give us the result after we have taken care of these children for six months?" We found out at once, when 100 children had been selected and told that they could have free dental service, that nevertheless they did not appear at the offices. We showed by this experiment not only the value of dentistry to those who would accept it, but the difficulty of applying it in schools under a system of this kind. By analysis we discovered one reason why these children did not come was because many of them could not afford the time or carfare. Then the dentists agreed not only to give services but to pay their carfare. In spite of this, however, we never did render service to 100 children any more than the Cleveland dentists did. However, we did serve 68 children and about half of these were reported by the orthodontists to have improved physically, mentally and scholastically. My own personal experience was peculiar, my office being in New York. The two children first referred to me failed to reach my office at the first appointment. I notified the board and two more children were allotted to me. Then on the following Saturday, four children arrived. As they were willing to come, however, I did the work. The point of interest to us is that out of the four sent to me, one had a pronounced Class III and one a pronounced Class II deformity. I thus immediately arrived at the relation between dentistry and orthodontia in school work. While it was possible for me to relieve the child from suffering in the Class III case by treating the decayed teeth, nothing that I could do as a dentist in six months would improve that child's mouth and as the child had a

very bad masticating arrangement, the filling of her teeth could hardly be expected to improve her physical condition. Most of the statistics that we have had are based on the examination of the mouths for caries. If a similar investigation were made in regard to metabolism, I believe that the magnitude of the orthodontic work required by children in the public schools would be something appalling and there would be the added difficulty of instituting proper prophylactic measures.

Another difficulty in democratizing either dentistry or orthodontia is the size of the community, especially in a large city like New York, where we have eight hundred and fifty thousand public school children. The children do not reside long enough in one locality to carry through the system of treatment, and the only solution to this problem is compulsory dental service in an infirmary located in the school building.

This week we are to dedicate for the first time I believe in the history of the world a monument placed in a public park in memory of a dentist. I firmly believe and prophesy that a second monument will be placed and dedicated in memory of a dentist. After the Cleveland experiment had failed to satisfy hard-headed business men in other parts of the country that dentistry in public schools would be worth the cost, Dr. Fones undertook another experiment in Bridgeport. He trained a number of girls to do prophylactic work and then put them to work in the schools. The first year they gave him $5,000 for this experiment. The second year they gave him $10,000. The third year they gave him $12,0C0. This year he asked for $25,000 and they gave him $35,000, proving in a practical way that they had become convinced. Dr. Fones will shortly be able to publish the result of five years of this kind of work and when these statistics are published, we will have a genuine foundation upon which to argue as to the advantage of democratizing dentistry.

Dr. S. P. Cameron.—I fully enjoyed listening to Dr. Suggett's paper and to Dr. Lischer's discussion, and also to the statistics presented by Dr. Ottolengui.

About six years ago I was in the position of taking care of an institution in which there were two hundred children that came and went every year. At that time we were all enthusiastic over the fact that malocclusion was caused by adenoids and enlarged tonsils. In starting in to go over these boys and making an examination of them in the college, I saw boys with magnificent sets of teeth, sets of teeth as good as you ever saw in your life, and their tonsils would almost choke them. When I started to examine the younger children I found they had beautiful developing conditions. I looked for adenoids and I found them. But previous to the time of my going there to take care of these fifteen hundred children one man went there one day a week at 4 o'clock. He had one little room, with a chair, cabinet, and so forth. Today there are five people spending all their time in the care of these children. There was no one among the medical staff who was paying any attention to these children until 1911. Operations were performed for the removal of adenoids and tonsils by physicians. The second winter we were there, in the boys who were sent to the infirmary, we reduced their oral troubles thirty-three and one-third per cent, and the next year when the boys were sent to the infirmary, there was a decrease of fifty per cent. A bulletin was published showing the value of the work that was being done. They found, as Dr. Ottolengui has pointed out, that the standing of the boys in school from a mental standpoint had been increased very materially since their teeth had been cared for.

An interesting fact to me was that the ages of these boys ranged from six to ten. We got them at an average of eight.

I have found that in taking up the practice of orthodontia in these children most of my work is in the grammar school, the boys ranging in age from eleven to twelve or thirteen. I have treated but two cases since I have been there (and I have treated something like over three hundred cases) that ever went from the grammar school and got into the high school and graduated. The boys that go there and graduate are different types of boys. They are different in their development both mentally and physically and in every other way. I found when I started with these boys with irregularities of the teeth in the grammar school, before they got into the grammar school they would go back into the technical school. They never got into the high school. It is very important for us to bear in mind that orthodontia has something to do not only with the development of the child but with its whole economy.

Dr. Julius Hovestadt.—This subject is extremely interesting to me. About fourteen years ago I showed before the Massachusetts Dental Society the beneficial effects on children by the proper care of their teeth. I had then a record of eleven years work. Dr.

Burns and several other writers had given me credit for giving the first correct record of this work. When I started the work in an orphan asylum I found there were fifty-five patients from the age of two to sixteen or seventeen years. There was a great deal of trouble among the inmates. There were diseases of all kinds. The home was never free from some form of disease of one kind or another, and many times they had some very serious contagious diseases, and it took us just about four years to wipe that out completely. My record, which was published in the *Dental Cosmos* in May or June, 1904, shows that the expenses for the home for medicine and medical services were reduced to something like three dollars and four dollars a year, whereas, these expenses in previous years ran up to one hundred dollars, and contagious diseases have been entirely wiped out. I think that was a remarkable record. I did not know what I was doing at that time; I had no idea that I had obtained such results till one day the superintendent, when I asked for the records, showed me these figures.

I really think that we can believe the report presented by Dr. Suggett. and that these things are possible because they have been proved by many other men besides him.

Dr. George F. Burke.—I regret very much to hear Dr. Ottolengui speak disparagingly of the mouth hygiene work done in Cleveland under the direction of Dr. W. G. Ebersole. I had the good fortune to be a visitor at the Marion School during the period his work was being done, and was very much impressed with what was being accomplished, though I am not in a position to support the accuracy of his findings, neither would I care to question his figures without being in possession of the facts.

The truth is that Ebersole was the first man in mouth hygiene to produce something tangible in regard to this subject, so as to impress those most interested in the value of clean, healthy mouths.

He focused the attention of both the dental and the medical profession, also the laity, on the mental and physical improvement made on the members of a class of school children, whose mouths were put in order and instructions given as to the proper chewing of food.

In his splendid volume, entitled "How to Live," edited by Irving Fisher, of Yale University, there is a chapter devoted to Ebersole's work in Cleveland, and it is a pleasure to find that due credit is given to those who so richly deserve it.

Dr. R. Ottolengui.—I rise to correct an erroneous impression which I seem to have made. I do not think the stenographer's notes will show that I criticized the Cleveland experiment at all. I was heartily in sympathy with Dr. Ebersole. I was friendly to the movement and approved of what he did. What I said was, and I say it again, that the experiment was not convincing because the manner in which it was conducted was not such as could be carried on practically in the schools thereafter. I did not say that the statistics were incorrect. They were absolutely correct so far as the twenty-seven children were concerned. Dr. Ebersole deserves credit for originating this experiment, but there was an error in it because of which the experiment failed to convince laymen and it was because of this fact that the Second District made their experiment. Had the Second District been the first to inaugurate the experiment, they would very likely have made mistakes also, but coming after the Cleveland effort, they were able to avoid the mistakes made there. But, of course, Dr. Fones' experiment is better than all because he actually does the work in the schools.

Dr. Suggett.—I am not surprised that children did not come to Dr. Ottolengui for charity service on their teeth. Children do not like dentistry and their parents do not like charity. Everybody detests charity, fortunately; it is not a solution of any problem.

But children go to school and they are there to be taught what they should know, one of the things that should be taught them, I hold, is the care of their teeth; as a scientific solution of the problem, not only of the teeth, but of other evils which develop out of bad teeth.

As to the effectiveness of the solution the cautious doctor warns us that the few experiments we have made are not enough to establish the optimistic conclusions which the experimenters and I have drawn. That is true. We have not made as many experiments as we should. That is my point. I want more such experiments started to make sure we are right; to establish scientifically our theory that expert, free instructions in the public schools in the practical care of the children's teeth will enable them to learn their lessons better and be more optimistic and capable and clearheaded than our generation. But I want to leave with you this argument for human cheerfulness, if not for scientific optimism; to wit, all the knowledge we have, and all our experience, all our experimenters and all our experiments so far made, go to show that we are on the right track.

COMPROMISE TREATMENT*

By A. C. Gifford, D.D.S., Oshkosh, Wisc.

ABOUT two years ago, I gave a paper before this society on the subject of "Compromise Treatment."† Some of the most interesting cases under treatment at that time, have since been completed, and it might be of interest to you to know just what results have been accomplished.

I believe that compromise treatment should always be used conservatively. Not every case of missing teeth, either congenitally or by accident or disease, will profit by this method, and judgment and discretion are needed to determine just what cases can successfully undergo this form of treatment. Generally speaking, compromise treatment should be advocated only during the years of greatest bone development, especially if much destruction and building of bone is necessary.

Substitution for missing teeth has long been a source of study, but I will venture to say, that if the case is taken early enough, compromise treatment offers the most effective solution to the problem. In the case of missing teeth, congenitally or otherwise, the natural procedure would be to move the remaining teeth back to their normal positions, which would be absolutely correct from the standpoint of normal mesiodistal relation of the teeth, but what advantage is there in having the teeth in normal mesiodistal relation and supplying the missing tooth with one of porcelain, causing mutilation of the teeth on either side of the space and future trouble. What orthodontic treatment really means in cases of this sort, is, I think, not always a normal mesiodistal relation, but the conservation of sound, live tooth tissue. It is either a case of normal occlusion with artificial restoration, or a compromise occlusion without mutilation and artificial substitutes. By this form of treatment, missing teeth can be provided for, and give, it seems to me, as good and often a better appearance than any substitute that might be supplied in the space opened to the normal tooth size, and in many cases the operation would be simpler, provided the conditions were the same. In the case of a child, you can readily see that it would almost be out of the question to successfully place an artificial tooth in a space opened to the required size, for the pulps of the teeth are large as a rule and should we wish to make restoration for the missing one, the substitute must be so constructed that it will not endanger the life of the other teeth. Temporary replacement would be the only solution to the problem. By compromising, we can avoid this difficulty, and it is one reason why I am so strongly in favor of this treatment for missing teeth. It would not be so difficult to successfully replace a missing tooth with a substitute, if we could do it ourselves, for we know

*Read before the meeting of the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., July 30-31, 1918.

†"Compromise Treatment, or Conservative Orthodontia," published in International Journal of Orthodontia, Vol. ii, No. 4, April, 1916, pp. 197-201.

what we want and what the results must eventually be so far as the physiologic tooth movement and occlusion are concerned. The general practitioner and crown and bridge man also have their ideas, and occasionally disagreements arise and we do not get exactly what we want. If, however, we are to follow some fixed rule, as has been the custom with a great many men in our specialty, we can, of course, resort only to the placing of some sort of artificial substitute.

The illustrations I showed at another meeting were of cases that had not progressed to the stage where you would have any inkling of what I consider a successful compromise. Some of these cases have since been completed and I shall show you in the accompanying illustrations, the results which have been accomplished.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Case 1.—This case (Figs. 1 and 2) has a lateral missing upon the left side, caused by an accident some three months before this model was made. Nature was trying to put the teeth in approximal contact and the space left by the tooth was closing. As the patient was only eleven years old, do you think it would have been good policy to have regained the space? The ideal conservation and compromise is shown in the next picture.

Case 2.—The next slide shows a congenitally missing lateral upon the right side (Fig. 3). The model shows the upper right posterior teeth just one cusp

mesial to the normal and the upper anterior teeth in labioversion. To have tried to place the molars in their normal mesiodistal relation would have required the moving of the right upper posterior teeth distally and that seemed to me unnecessary and an impractical way of treating the case especially as the lateral would have had to have been replaced. Fig. 4 will show the completed case. The canine has not made the very best lateral, but is it not better than a porcelain one? I am sure it will be more serviceable than any substitute that could have been used.

CASE 3.—We have here a case of congenitally missing laterals on each side. The radiogram showed no teeth in process. (Fig. 5.) This was a hard case to treat as one may imagine, for I believe that the teeth should be moved singly

Fig. 5.

Fig. 6.

and bodily. The left canine being in torsoversion and having a very large root was especially obstinate to treatment. By carrying out my ideas I finally attained the results that are shown in Fig. 6. Some may not believe that this is the plan that should have been followed, but to the conservative mind it will not fall short of ideal results, for I know of no other treatment that would have produced any better.

CASE 4.—In this case (Fig. 7) you will notice that the canines are missing. History gives us the extraction of these teeth when they came in labial to the rest of the teeth. The facial deformity can well be imagined. The young man was nineteen at the time of the application of the appliances, but before I had

finished the case he enlisted for service. The model in Fig. 8 was taken on the day before he left. In the treatment of this case, I proceeded as if it were a regular mesioclusal type. The results I was striving for are plainly shown in the second model of this case.

CASE 5.—Fig. 9 shows the second upper premolars missing on both sides.

Fig. 7.

Fig. 8.

Fig. 9-*A*.

Fig. 9-*B*.

Fig. 10.

At the time the first model was made, the patient was only ten years old and I decided that it would be most advantageous from all viewpoints, to move all of the upper teeth forward by intermaxillary elastics, rather than leave the first molars in their normal mesiodistal relation and open the space for the missing

Fig. 11.

Fig. 12.

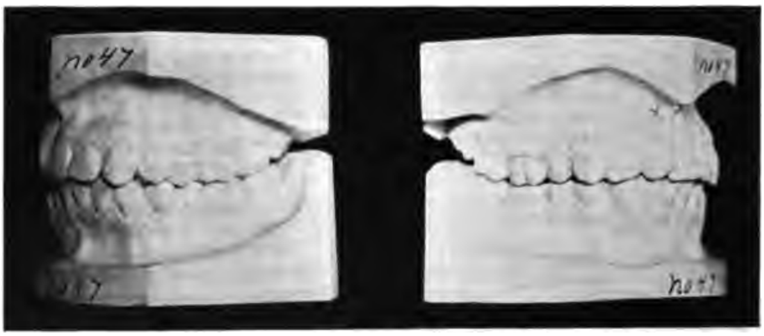

Fig. 13.

Fig. 14.

teeth. Fig. 10 shows the teeth in approximal contact, but not in as good occlusion as they are at the present time. At the time the last model was made, the teeth had not developed fully and consequently the force of the inclined

planes had not had an opportunity to act. At the time I last saw the patient I noticed a great improvement over this model.

CASE 6.—When the first molars have been lost by disease, if the patient is within the age of bone development, it behooves us to put the second molar in the place of the missing first molar (Fig. 11). It is so easy a matter to place the second molar in approximation with the second premolar in the treatment of cases that I see no reason for retaining the space. The second molar occludes very nicely in the place of the first molar, and when the third molar erupts, I believe it will be a better and a stronger tooth than it might otherwise have been. In fact, after a little while, I doubt very much whether the change will be noticed. This case needed considerable more treatment and Fig. 12 shows what has been accomplished.

CASE 7.—The case that is now shown has a missing premolar upon the right side. The left upper teeth were all one cusp mesial to the normal. The right is also somewhat mesial, but not, in this particular case, the desired distance. The upper teeth on the left, from central to second molar, were moved distally into normal occlusion, after the third molar was extracted, and after the supernumerary was (x) moved, the right half of the upper teeth were moved mesial enough to put all of the teeth in approximal contact. This seems to me logical and I believe I have produced a nice set of teeth without mutilation or an artificial substitute (Fig. 14).

I have only illustrated the use of compromise treatment in the cases of missing teeth, but there are many other ways by which we can compromise and extract a tooth occasionally without any undesirable results esthetically or from the standpoint of mastication. As I said before, one must use discretion in the treatment of cases by this method. The fixed plan of normal occlusion does not always give the results we are striving for, and a little compromise very often relieves our responsibility.

DISCUSSION

Dr. Burt Abell, Toledo, Ohio.—I do not believe I can add anything of value to what Dr. Gifford has said. I think he has gone to a lot of trouble in some of these cases to get better occlusion than I would feel justified in doing. While we take the short way out of it on the older cases, on the younger cases, we do every bit of work that is needed to be done. I do not feel that anybody is justified in so arranging teeth that a patient has to wear what I call a crippled tooth in the mouth. No bridge, or substitute can possibly take the place of the natural teeth. We can bridge to get normal occlusion but why should we make an effort to get normal occlusion if we have not the material there with which to get it? We never can move these teeth into a compromised position—I say that advisedly—and have all of them absolutely occlude as well as they would in the occlusion that was intended by nature. But it is a great deal better to mismatch teeth (I do not know that I want to be quoted on that term) to put them into other positions rather than to put them in normal positions and supply the missing teeth artificially. I am very much in favor of orthodontic compromise treatment if there are missing teeth rather than to put them in their normal positions and have to supply teeth artificially to hold them there permanently.

Dr. William C. Fisher, New York City.—I have nothing to defend. I admit I am guilty. I am very glad indeed that Dr. Abell took the stand he has so decidedly. In the last two years I have been in close touch with Dr. Dewey on almost the same subject, and he goes to the point of sacrificing a good tooth in order to get a compromise, so that he won't have to put in artificial substitutes. If the x-ray shows that a bicuspid is lack-

ing, I will sacrifice the bicuspid in the opposing arch on this side rather than open it up and put in a substitute if the upper teeth are sound and good and the patient is young.

I have one case (I call it a very sad case) that taught me the greatest lesson I ever had in orthodontia, and it taught me the lesson that every man has to have sooner or later, namely, that I did not know very much about orthodontia. That case came to me after it had been in the hands of a specialist in orthodontia, a man who has practiced it exclusively. He had the case for over two years. He had used several appliances, and the last appliance was pin and tube. There was lacking in the lower jaw a bicuspid on each side of that arch. In the upper arch the full complement of teeth was present. They were all inclined to decay. The girl was not strong. She was about twelve years of age. I decided to use Dr. Ellis' appliance, which you may have seen published two years ago, and open the space. When I got the space opened and decided to put in a substitute, I could not bring myself to devitalize the teeth and place in two artificial substitutes for the girl to wear during the rest of her life, neither could I bring myself to construct anything removable with clamps. I then concluded I would go all over my case again by extracting the bicuspids in the upper jaw. Then I had to close in my space, and I assure you that it closed in quicker than I opened it, but I had to use force. At last, after working on the case for over two years I concluded I had secured as fine a result as was possible in a girl now nearly sixteen years of age, and she had been wearing the orthodontic appliance for five years with a slight interval in between. I said to her father, "It is my opinion this child has had all the orthodontia she should ever have; we have not secured a perfect condition, but the removal of these two bicuspids did more for the child in six months than the exclusive orthodontist and general practitioner did in five years.

DEPARTMENT OF
ORAL SURGERY AND SURGICAL ORTHODONTIA

Under Editorial Supervision of

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Professor of Oral Surgery in Marquette University

Clinical Observations Concerning Malignant Tumors of the Jaws. A. J. Ochsner. Annals of Surgery, 1918, lxviii, 136.

Ochsner reports his observation of 100 cases of malignant tumors of the upper and lower jaws from the standpoint of the clinician. The actual cautery was used in every case in a most vigorous manner. Two cases died from hemorrhage from the carotid artery where the tumor had extended into the neck. The oldest one of his cases operated upon by means of the cautery has lived 29 years since the operation and is still in excellent health.

Out of 100 cases, 67 per cent were carcinoma; 16 per cent epulis; 16 per cent sarcoma; and 1 per cent chondrosarcoma. The origin of these new growths was noted and in the cases of carcinoma and epulis the following distribution was found: 47 cases originated from the inferior maxilla; 6 from the antrum of Highmore; 25 from the superior maxilla; 3 from the cheek; 1 from the parotid gland and 1 from the palatine bone.

In the sarcomatous growths the examination showed that 8 cases originated in the superior maxilla; 4 in the inferior maxilla; 3 in the parotid gland; 1 in the soft palate; and 1 in the cheek.

Ochsner believes that the teeth are usually the cause of malignancy of the jaws. He holds that broken-down crowns and sharp projecting roots, together with faultily constructed bridges and crowns, affording a breeding place for bacteria, are predisposing factors.

The frequency of the occurrence of the malignant tumors in the male was found to be much lower than the percentage given by Blair; 72 of the cases occurred in the male, while 28 affected the female. The percentage for the female was considerably lower in the cases of carcinoma than in those of sarcoma and epulis. Of the 67 cases of carcinoma it was found that only 11 were female patients, while in the 33 cases of sarcoma and epulis 17 were female patients.

As to the duration of the condition before the admission of the patient into the hospital, the following facts were determined: 25 per cent entered before the third month; 25 per cent of the cases entered before the sixth month; 23 per cent before the second year; 27 per cent after the second year. In 65

per cent of the cases no statement was made with regard to lymph gland involvement. Of the remaining 35 cases, 25 showed enlarged glands.

The mortality following these operations was as follows: 3 per cent died during the first day following the operation; 4 per cent died before the fifth day; 5 per cent died before the twentieth day; 3 per cent died before the fortieth day; and 5 per cent died after the fortieth day. The total mortality of patients while in the hospital amounted to 20 per cent. All of these fatal cases, except two, were carcinomatous, the two exceptions being sarcomatous. It is interesting to note that in 40 per cent of these fatal cases, a previous incomplete operation or an excision of a piece of tissue for the diagnosis had been performed. In the balance of the cases injection of iodine or oil, application of plasters or acid, teeth extraction following the appearance of the lesion, or x-ray application had been carried out.

Of the 100 cases treated in this series, 15 returned with recurrences. Ten returned once, 1 returned twice; and 4 returned three times. The permanent results of this series of cases have not been determined.

Some Vital Phases of Fracture of the Jaws. C. J. Lyons, Journal American Medical Association, 1918, lxxi, 164.

Lyons calls attention to the fact that fractures of the jaws will differ from fractures in other parts of the body in that they are more liable to infection on account of the close proximity of the bacteria-laden fluids of the oral cavity.

He also calls attention in the consideration of infection in fractures of the jaws, to the presence of alveolar abscesses, which may be existing at the time of the fracture or may be superinduced at the time of the injury. This will greatly delay the process of repair and should be eradicated before repair can take place.

Another condition which will complicate healing of jaw fractures is infection of the antrum.

The treatment of fracture of the jaws consists of the fulfillment of three principal indications; (1) reduction of broken fragments; (2) retention of the parts in normal relation; (3) prevention or control of inflammatory processes.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

RADIUM IN THE TREATMENT OF SARCOMA AND CARCINOMA*

BY G. H. SCIARONI, M.D., M.C.L., FRESNO, CALIF.

IN discussing radium for the treatment of cancers and sarcomas it will not be out of place to first give a brief history of this most wonderful element.

Radium was discovered by Madam Curie while working out a master's degree in her husband's laboratory in 1898. A short time after the isolation of the element, a tube containing a small amount was given to Professor M. Henri Becquerel for experimental work. The tube was placed in his vest pocket to be removed a few hours later. At the time no inconvenience was noted but about two weeks later a burn which corresponded to the size of the tube appeared on the abdominal wall. This was the famous Becquerel burn and from that day to this when those unfamiliar with the action of radium hear of it they immediately think of a burn, and more than one unitiated pathologist has made the statement that radium cures by burning. Nothing can be farther from the actual fact. It is true that it liberates heat and will burn in the course of time, but a burn is easily avoided when the radium is properly applied. Unfortunately it is not as simple to handle as some other agents, and the technic of its application can only be learned by long and tedious study. The burns that are seen today following radium applications I believe to be due to overtreatment.

Radium is derived from uranium by atomic reduction and belongs to the strontium-barium group of the alkaline earths. When freshly prepared it looks somewhat like brown sugar except it is not crystalline and does not glisten. It has a characteristic spectrum, an atomic weight of 226 and loses a portion of its atom to become a gas called emanation. Pitchblende contains one part of radium to 3,000,000 parts of uranium.

*Read before the San Joaquin Valley Dental Society, May, 1918.

There are a number of radioactive substances, fifteen in the radium group and eleven in the thorium group, any of which may be recognized by (1) their effects on sensitive photographic plates, (2) their ability to produce fluorescence, (3) their ability to ionize an air and, (4) their production of heat. From all of these substances there is an emission of rays, from which their therapeutic value is derived. These are classified according to their physical properties into alpha, beta, and gamma rays.

Of the three types, the alpha particles are the least penetrating, being completely stopped by a thin sheet of paper and not being detectable after passing through three inches of air. They are positively charged minute particles the size of atoms, the action of which we see in a spinthariscope, a screen of zinc sulphide in front of which there is a small fragment of radium, so small it can not be seen with the naked eye. From a gram of pure radium bromide it is estimated that twenty thousand million of these particles are expelled per second with a velocity of approximately one-tenth that of light.

The beta rays are negatively charged electrons, smaller than the alpha and travel with the velocity of 170,000 miles per second. Their penetrating power is therefore much greater than the alpha particles, it requiring a piece of lead two millimeters in thickness to intercept them. They will penetrate several centimeters of tissue.

The gamma rays are ether vibrations rather than particulate, as are the alpha and beta rays. They have a much shorter wave length than visible light and their penetrating power is extraordinary. Even the interposition of the human body does not intercept all of them. In the therapeutic application of the rays, because of these properties it is possible to use them all together or separate them, as may be desired.

For the purpose of application radium may be obtained in the form of varnish applicators or in small glass tubes further encased in brass, platinum or silver capsules. The latter prevents loss in case the glass tube is fractured. The rays pass from the tubes in radial lines, thus producing a sphere of radiation. The walls of the tube intercept the alpha rays and therefore only the beta and gamma rays are used in the treatment of disease; the dosage depending on the age of the patient, the nature and extent of the condition, the amount of radium to be used, the screening, etc. It is the ideal aim in the treatment of any condition to obtain the same intensity dosage at the point of greatest extension, as at a point nearest the radium.

The rays being given off from a point in every direction their intensity will vary inversely in proportion with the square of the distance. For example, a unit radiation may be obtained in one minute at a point one millimeter distant from the radium that it would take 625 minutes to obtain at twenty-five millimeters. When the rays strike a substance, the substance becomes the source of secondary rays which are similar to the primary beta rays emitted from the radium. It is the action of these rays that is usually responsible for the so-called radium burns, but fortunately by the interposition of rubber dam between the screen and the lesion such can be prevented.

Radium is said to be possessed of a selective destructive action and a general destructive action, and the common impression that it acts by burning

is erroneous. The selective destructive action is advocated because of the fact that a tumor is very often seen to disappear from beneath the skin, after the use of radium, without any apparent effect upon the normal tissues. As a matter of fact, there is a marked selective tendency in this direction and assuming that radiation has a deleterious effect upon all tissues this selective action may be explained in the following manner, which, to me, seems to be the most plausible theory concerning the effect of the rays on normal and pathologic tissue.

First, although the radium produces a certain deleterious effect on all living tissues, the fluids and protective agencies of the body are all constructed to

Fig. 1.

Fig. 2.

help the normal and though weakened the normal cells do not die. Second, the pathologic tissues are weakened to the same extent as the normal, but since the body fluids and normal protective agencies are not constructed in the aid of the up-keep of these pathologic cells they disappear. Another fact concerning the selective action of the rays and the body's resistance is that the tuberculous glandular involvements disappear under radiation, while tubercle bacilli growing in culture in the test tube are unaffected by its rays.

In explanation of the action of the rays in this manner, certain other facts well known to those familiar with the use of radium can be explained. First and foremost, the fact that under identical conditions as regards dosage and application, and identical conditions as regards the patient, we occasionally fail to get a result in one, while in the other the sensitiveness of the tumor is most remarkable. I have seen cases that were apparently absolutely hopeless whose

conditions yielded in a way that seems almost magical; however, in making this statement it is not desired that it shall be interpreted as a plea for very advanced cases.

It would seem that for a cure in malignant disease everything points to an early diagnosis and treatment; yet in the face of an absolute diagnosis of malignant disease, the patient will not always take the advice of the physician who recommends immediate attention, but will go shopping from doctor to doctor, just as we see shoppers go from one department store to another, until some quack guarantees them a cure without the use of a knife. The next time we see them they are in an advanced stage of malignancy with metastases to the neighboring glands and the inevitable end close at hand.

In Fig. 1 is a typical illustration of an extensive carcinoma in the cervicomandibular region. Fig. 2 is the same case thirty days after treatment.

SUMMARY

1. Radium is the most powerful destructive agent known for tumors.
2. It will reduce many inoperable carcinomas to operable conditions.
3. In the proper hands it will save many lives that would otherwise be hopeless.

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EDITORIALS

Malocclusion and Mental Deficiency

DURING the last few years many articles have appeared dealing with the relation of malocclusion to mental deficiency. Several years ago a very prominent authority examined a number of patients who were mentally deficient, making some of his examinations among inmates of an insane asylum, and he reached the conclusion that malocclusion was very prevalent among people who were mentally abnormal. Similar investigations were carried on by another authority who not only confined his investigations to inmates of an asylum, but made examinations among children in public and private schools, as well as among patients in his own practice. He found that there was just as great a percentage of malocclusion among mentally normal patients as there was among the mentally deficient. The results of these investigations, as well as those obtained through researches carried on by other men, would seem to

indicate that the real truth of the matter lies somewhere between the two extremes.

The great trouble among those who wish to establish a relation between malocclusion and mental deficiencies seems to be that they fail to determine which is the cause and which is the effect. In a mentally defective child suffering from malocclusion, the malocclusion may have nothing to do with the mental debility; in other words, the malocclusion may be the result of a condition having nothing whatever to do with the development of the mind—a condition which may be present in a child who is growing normally. Many cases of malocclusion may be placed in this category.

It may be true that a majority of patients with impaired mentality have malocclusion, but the mental condition is not the effect of the malocclusion; there is an abnormal development in the entire system which not only produces the mental debility, but the malocclusion as well. In cases of this kind treatment of the malocclusion would in no way benefit the mentality of the individual, unless it would enable him to breathe better and masticate better, thereby improving the general physical development. Although the malocclusion has not been the cause of the mental deficiency, or the mental deficiency the cause of the malocclusion, there is a close relationship existing between them which we are forced to recognize. This is made evident by the fact that almost every child suffering from malocclusion shows mental improvement when the malocclusion is corrected. This is proved by the higher standing in school. They likewise show an increase in physical development. Because of the improvement in the grades at school during the treatment of the malocclusion, some men have attributed the mental improvement to the correction of the malocclusion. While it is true that the mentality has been bettered, it is also true that the physical development has been improved, and we are again confronted with the problem of proving whether the mental improvement is the direct result of expanding the dental arches and correcting the malocclusion, or whether it is a result of the improved physical condition. It may be possible that a better mastication and a better respiration play more of a part than is generally believed.

Some writers have advocated the theory that in extreme cases of malocclusion, especially those cases associated with a narrow upper arch, there is a lack of development at the base of the brain, causing pressure upon the pituitary gland and the nerves at the base of the brain, and consequently interfering with the proper function of the brain. Cases have been reported in which normal children with small arches have become insane, and some men have attributed the insanity to the narrow upper dental arch. It has been shown that nerve impaction and irritation caused by impacted teeth have produced nervous conditions which were relieved by the removal of the impaction. Impacted teeth may produce irritation great enough to cause mental deficiency, and it would also be reasonable to believe that crowded upper arches and bad cases of malocclusion would tend to produce abnormal mental conditions and probably insanity in some cases. A case of a child reported by Dr. Price a few years ago

showed that the mental condition became greatly improved immediately following the expansion of the upper arch. During the period of retention the retaining appliance broke and allowed the upper arch to relapse; the mental deficiency of the child became as bad as it was before the expansion of the upper arch. Orthodontic treatment was again instituted and the mental condition of the child again improved. In this case it would seem that the narrow upper arch did exert some pressure upon the base of the brain, and through the expansion of the arch and the associated structures, the pressure was relieved and the mental condition of the child improved.

As a result of the various factors entering into the relation between malocclusion and mental deficiency, we are forced to believe that the result of correction of the malocclusion, whether by relieving pressure at the base of the brain or by improving mastication and respiration, thereby improving the physical condition of the child, is important enough to recommend orthodontic treatment. We can not always promise the parents that the correction of the malocclusion will improve the mental condition of the child, but it offers so many possibilities—relief of the nerve pressure, better mastication, and better respiration—that there is no other one single thing that offers as much of a chance for betterment. Again, following the facts that the correction of malocclusion improves the mental and physical condition of all children as shown by the increase in weight, standing at school, etc., we are justified in believing that it holds some possibility even in some of the most undesirable cases. Realizing the importance of normal mastication and normal breathing and the possibility of obtaining these, we believe that the advantage of orthodontic treatment can not be too strongly recommended. In the case of a child suffering from extremely abnormal mental development, even though the mental condition itself is not improved, the appliance will in no way interfere with the mentality, and it makes possible the increased physical development which can not help but be beneficial.

Orthodontic Society Programs Wanted

WE are requested to announce by Dr. Bernhard W. Weinberger, of 40 East 41st Street, New York City, that he would like to secure copies of the following programs:

1. Programs of the 1st to 13th Annual Meetings of the American Society of Orthodontists.
2. Programs of the Alumni Society of the Angle School of Orthodontia, prior to 1909.
3. Programs of the Alumni Society of the Dewey School of Orthodontia, 1st to the 7th Annual Meetings.
4. Programs of the first four meetings of the Pacific Coast Society of Orthodontists.
5. Programs of the Central Association of the Alumni Society of the Angle School of Orthodontia.

Doctor Weinberger wishes to secure these programs to complete his records for the "History of Orthodontia," which is now running serially in *The International Journal of Orthodontia.* These programs will be returned by Doctor Weinberger as soon as copies can be made of same.

We hope our readers who may have any of these programs will communicate with Doctor Weinberger immediately in order that he may complete the notable work he has undertaken.

Meeting of American Institute of Dental Teachers

THE next annual meeting of the American Institute of Dental Teachers will be held at Hotel Piedmont, Atlanta, Georgia, January 28, 29 and 30, 1919. Papers on the teaching of war dentistry and an exhibit of war appliances will be the main features, and along with these will be the usual papers on teaching methods.

All persons interested are cordially invited. Abram Hoffman, D.D.S., of 381 Linwood Avenue, Buffalo, N. Y., is Secretary of the Association.

Alumni Society of the Dewey School of Orthodontia

THE Alumni Society of the Dewey School of Orthodontia will hold their next annual meeting in St. Louis, March 6, 7, and 8, 1919. The usual high standard of the meetings of this Society will be maintained. All interested in orthodontia are welcome. Address communications to Dr. George F. Burke, 741-43 David Whitney Bldg., Detroit, Michigan.

Cancellation of Appeal for the Collection of Scrap Platinum

THE Chief of the Platinum Section and the Section of Medical Industry, War Industries Board, in a recent communication expresses appreciation of the hearty response made by physicians, dentists and others when the call for scrap platinum was made.

As the Governmental demand for platinum in the making of explosives, etc., has been tremendously decreased by the curtailed war program, it is requested that no further scrap platinum be tendered to the Government through the channels indicated in former communications.

Another Liberty Loan Coming

SECRETARY of the Treasury McAdoo has announced that, no matter what the results of the pending overtures for peace may be, there will be another Liberty Loan. To use his expression, "We are going to have to finance peace for a while just as we have had to finance war."

There are over 2,000,000 United States soldiers abroad. If we transport these men back to the United States at the rate of 300,000 a month, it will be over half a year before they are all returned. Our army, therefore, must be maintained, fed, and clothed for many months after peace is actually declared.

The American people, therefore, having supported the fourth Liberty Loan with a patriotism that future historians will love to extol, will have an opportunity to show the same patriotism in financing the just and conclusive victorious peace whenever it comes.

Not for a moment, however, is the treasury acting an any assumption that peace is to come soon. Until peace is actually assured the attitude of the treasury and the attitude of the whole United States Government is for the most vigorous prosecution of the war, and the motto of force against Germany without stint or limit will be acted up to until peace is an absolute accomplished fact.

One more Liberty Loan, at least, is certain. The fourth loan was popularly called the "Fighting Loan;" the next loan may be a fighting loan, too, or it may be a peace loan. Whatever the conditions, the loan must be prepared for and its success rendered certain and absolute. Begin now to prepare to support it.

Why We Should Join the Red Cross

HOW American Red Cross physicians engaged in relief work in Jerusalem are accomplishing worth-while results in the face of great difficulties—and what they are up against, is shown in a report just received here from W. S. Dodd, A.R.C. physician working at Mejdel.

With two capable English trained nurses, and three native helpers, more or less useful, Dr. Dodd, his "hospital" housed under tents, performed 252 operations in seven weeks, besides giving medical examinations, treatment and counsel to hundreds of the destitute inhabitants and refugees.

His report says in part: "The work of the hospital was of the plainest sort, it might be called primitive. About twenty-five tents comprised the hospital proper, with a dispensary tent, and tents for the living quarters of the staff.

"The soil was all the purest sea-sand with thistles and scant grass; going barefoot was the universal custom, and in our own quarters we of the staff used to follow that custom with great pleasure. * * * *

"The professional side of the work was of the greatest interest to me and every day was a pleasure. The clinics numbered sixty to a hundred a day. Of course, we had all classes of cases in medicine and general surgery, but by far the larger proportion of our patients were eye-cases.

"Of the 252 operations that I did in less than seven weeks, 222 were for the eyes. This is the number of persons operated on, most of them having more than one operation, perhaps on all four lids, so that I really operated on 408 eyes.

"There were some cataracts, not more than would be seen in the same number of cases elsewhere, but trachoma and its consequences accounts for almost all of the eye troubles in this land. I set out to treat these cases radically and secured fine results when I could keep the patients long enough for a reasonable after-treatment. But even so, the number of eyes that can be saved from partial and total blindness is large and the economic value of each eye thus saved is enough to make the prosecution of this line of work of the greatest importance for the redemption of the land.

"The accident cases are always interesting. I had the last end of treatment of some cases of bombed hands, of which there had been quite a number in the earlier days. These were largely in children, and were due to their picking up unexploded Turkish bombs that were lying in the fields from the time of the British advance in the Gaza region. Many fingers and even hands were lost from this cause.

"Vermin was the great enemy we had to fight. Fleas were hardly counted as a problem because we could do nothing against them, they were everywhere and inevitable, and so far as we know at present not being the carriers of any special disease, did not come within the hostility of a medical conscience.

"Lice and maggots were a daily terror. How many wounds and injuries came to us filled with maggots I can not tell. A favorite dressing for a wound is a piece of raw meat, a breeding place for maggots, and they can hardly be blamed for invading the adjoining premises.

"Many a child had to be put under chloroform in order to search out and pull from their hiding places deep in the middle ear a half dozen wriggling maggots whose every motion was causing torture to the innocent victim.

"A woman came to the clinic complaining of headache. A single sore on her face led to questioning, and when she rather unwillingly undid her turban we found an exaggerated case of impetigo, and every separate sore was as if the whole thickness of the scalp down to the bone had been punched out, and every sore was a nest of maggots. I removed 60 at the first seance, and at the first dressing next day the nurse had more to do. The headache was cured without further treatment. And these are not the most loathsome cases that we saw.

"Another great difficulty with which we had to contend was the filthy habits of the people. In spite of providing proper sanitary facilities, we were compelled to have a scavenger go around every morning and clean up the filth from around the tents of the patients. The women were as bad offenders as the men. We made it a rule that anyone known to have violated these simple sanitary regulations must go without their dinner next day, and this was quite an effective punishment."

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